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# REPORT



OF THE

## SUDAN MEDICAL SERVICE

FOR THE YEAR

# 1940





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## SUDAN MEDICAL SERVICE.

### ANNUAL REPORT 1940.

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# ANNUAL REPORT OF THE SUDAN MEDICAL SERVICE FOR THE YEAR 1940.

## GENERAL HEALTH.

The state of public health in the Sudan remained satisfactory during the year with the exception of an extensive outbreak of Yellow Fever in the Nuba Mountains. Smallpox spread into Darfur and Kassala Provinces from neighbouring countries but it was possible to prevent an epidemic. Relapsing Fever occurred as usual along the line of the pilgrim route across the central Sudan. Cerebrospinal meningitis occurred in the Southern Sudan. The low Nile flood and well spaced rains again resulted in a low incidence of malaria.

## HEALTH OF OFFICIALS.

NATIONALITY.	Number of officials employed	Total		Average days Sickness		Died	Invalided.
		Placed on sick list	No. of days sick	For all officials	For those who were sick		
British ... ..	773	279	2,481	3.21	8.89	3	5
Sudanese ... ..	3,436	812	6,701	1.95	8.25	5	20
Egyptian ... ..	485	122	883	1.82	7.23	3	6

Lack of leave and the strain of the war had an adverse effect on the health of British officials.

## PROGRESS OF WORK.

The hospital work in many parts of the country was disorganised temporarily owing to the Sudan becoming a theatre of war. Medical work as a whole had to be maintained on a care and maintenance basis owing to the number of British and Sudanese Medical Staff of all cadres who were in the army. It says much for the remaining staff, who were often carrying on in the face of great difficulties, that the medical work as a whole was not more seriously affected. It has been possible to maintain progress in preventive medicine as this branch is so important in war that it must be maintained at a high standard of efficiency at all costs. The training of subordinate sanitary staff continued without interruption. The school medical and dental services were well maintained. Extensive research was carried out on Kala-azar in the Eastern Sudan, and on Yellow Fever in the Nuba Mountains.

## EPIDEMIC DISEASES.

An extensive epidemic of Yellow Fever occurred in the Nuba Mountains. The disease broke out in July and by the end of the year had practically died out. 15,633 cases occurred with 1,627 deaths. This disease had not previously been



reported in the Sudan. Cases of smallpox were reported in Darfur and Kassala Provinces, introduced into the Sudan from French Equatorial Africa and Arabia Seoudia respectively. Relapsing Fever occurred in the central Sudan during the winter months and was particularly prevalent in the irrigated area of Gezira Province. Cerebrospinal meningitis was prevalent in the western part of Equatoria Province.

## ENDEMIC DISEASES.

Bilharziasis has ceased to be of any public health importance in the Northern Sudan although stringent measures are necessary to maintain this state of affairs. The number of cases of Kala-azar reported was higher than normal probably due to the special attention given to the disease by the research staff of the Stack Laboratories and the increased popularity of hospital treatment as the result of the employment of new and more efficient drugs. The incidence of Leprosy is probably slowly declining. Malaria was far less prevalent than usual in the Northern Sudan owing to the exceptionally favourable climatic conditions. Cases of Sleeping Sickness continued to occur in the Zande district of Equatoria Province but no cases were reported from the Kajo Kaji district, where the disease occurred last year.

## QUARANTINE.

3204 pilgrims left the Sudan for Jedda and were vaccinated and inoculated before departure with calf lymph and Cholera vaccine made in the Stack Laboratories. 14 cases of Smallpox occurred among the returning pilgrims which included many unvaccinated pilgrims who had left via Massawa. While the last boatload of pilgrims were in quarantine the huts were bombed and machine-gunned by an Italian aircraft and four pilgrims injured.

## TRAINING.

15 medical students were under training at the Kitchener School of Medicine, during the year, and training courses were held for public health officers, dispensers, sanitary overseers, female nurses, midwives, laboratory assistants, medical assistants, and hospital orderlies. Seven medical students passed the final examination of the Kitchener School of Medicine, and one public health student obtained the diploma of the Royal Sanitary Institute. Four medical officers completed a six months postgraduate course in Khartoum in April.

## STACK MEDICAL RESEARCH LABORATORIES.

### Routine Work.

25,686 routine examinations were carried out compared with 24,540 in 1939, and 22,633 in 1938. The outbreak of war with Italy was followed by a temporary drop in the number of specimens received from civil hospitals but there has been a considerable increase in the amount of work carried out for the army. 187 routine bacteriological examinations of water were carried out, and the following quantities of vaccine made in the Laboratories were issued during the year :—

Vaccine lymph ...	...	...	...	...	...	...	...	567,440 doses
TAB vaccine ...	...	...	...	...	...	...	...	34,600 ccs.
Anti-Rabic vaccine ...	...	...	...	...	...	...	...	57,825 ccs.
Staphylococcus aureus vaccine	...	...	...	...	...	...	...	825 ccs.
Cholera vaccine ...	...	...	...	...	...	...	...	7,350 ccs.

155 biochemical tests were carried out compared with 193 in 1939, and 104 in 1938.

## Research Work.

Investigations were carried out on the following subjects :—

- (1) Kala-azar.
- (2) Typhoid Fever.
- (3) Vaccine lymph.
- (4) Yellow Fever.

The Medical Entomologist continued to carry out malarial investigations in the Gezira Province. He also carried out entomological research in the Eastern Sudan on the sandfly distribution and habits as regards Kala-azar, and in the Nuba Mountains on those of the *Aedes aegypti* and other possible vectors of Yellow Fever. The Wellcome Chemical Laboratories carried out analyses for departments and private firms. 2.115 analyses were carried out during the year.



## EPIDEMIC DISEASES.

### CEREBROSPINAL MENINGITIS.

4032 cases were reported with 796 deaths from the following Provinces :—

PROVINCE.	Cases.	Deaths.
Darfur ... ..	13	5
Equatoria ... ..	3,577	738
Gezira ... ..	7	3
Kassala ... ..	1	1
Khartoum ... ..	1	—
Kordofan ... ..	6	3
Northern ... ..	3	2
Upper Nile ... ..	424	44
TOTAL	4,032	796

The incidence during the last ten years has been as follows :—

YEAR.	Cases.	Deaths.	YEAR.	Cases.	Deaths.
1931. ... ..	348	240	1936 . ... ..	13,440	8,906
1932 ... ..	532	384	1937 ... ..	446	293
1933 ... ..	166	131	1938 ... ..	234	124
1934 ... ..	4,231	3,341	1939 ... ..	2,714	647
1935 ... ..	3,249	2,154	1940 ... ..	4,032	796

The disease continued to be epidemic in the western part of Equatoria Province and spread to Upper Nile Province where cases were reported along the White Nile from Tonga in the south to Kaka in the north. These outbreaks died out with the onset of the rains but cases were again reported from Equatoria Province in the Autumn. Treatment with intrathecal and intramuscular injections of drugs of the Sulphonamide group again reduced the mortality of treated cases to under 10% but it was often impossible to reach cases in time in the remote areas of the Southern Sudan.

### DIPHTHERIA.

114 cases were reported with 8 deaths.

The distribution was as follows :—

PROVINCE.	Cases.	Deaths.	PROVINCE.	Cases.	Deaths.
Darfur ....	5	—	Khartoum ....	58	6
Gezira ....	15	—	Kordofan ....	12	1
Equatoria ....	—	—	Northern ....	9	—
Kassala ....	13	1	Upper Nile ....	2	—

The incidence for the last ten years has been :—

YEAR.	Cases.	YEAR.	Cases.
1931 ....	183	1936 ....	63
1932 ....	138	1937 ....	36
1933 ....	51	1938 ....	51
1934 ....	34	1939 ....	77
1935 ....	60	1940 ....	114

## RELAPSING FEVER.

1487 cases were reported with 45 deaths.

Cases were distributed among Provinces as follows :—

PROVINCE.	Cases.	Deaths.	PROVINCE.	Cases.	Deaths
Darfur ....	116	9	Khartoum ....	27	—
Equatoria ....	—	—	Kordofan ....	11	1
Gezira ....	782	22	Northern ....	—	—
Kassala ....	551	13	Upper Nile ....	—	—

The incidence during the last 8 years has been as follows :—

YEAR.	Cases.	Deaths.	YEAR.	Cases.	Deaths.
1933 ... ..	—	—	1937 ... ..	374	48
1934 ... ..	1	—	1938 ... ..	1,124	116
1935 ... ..	—	—	1939 ... ..	1,006	92
1936 ... ..	22	—	1940 ... ..	1,487	45

An outbreak of this disease can practically always be expected in the irrigated area of Gezira Province and in Darfur, Kordofan and Kassala Provinces during the cold weather. This year it was reported in February, March and April, and from September to the end of the year. It appears that this disease is now becoming endemic in the Sudan, but is still more or less confined to the pilgrim route from Darfur to Kassala provinces across the Sudan where it is probably constantly being reintroduced. Facilities for treatment are exceptionally good in this area with the result that the mortality is low. Rigorous preventive measures are necessary to prevent extensive epidemics. Delousing stations are established on traffic routes across the Sudan, and extensive delousing campaigns are carried out in the villages and encampments of infected areas.

## SMALLPOX.

515 cases were reported with 104 deaths in the following provinces :—

PROVINCE.	Cases.	Deaths.	PROVINCE.	Cases.	Deaths.
Darfur ....	226	28	Khartoum ....	1	—
Equatoria ....	56	3	Kordofan ....	1	—
Gezira ....	15	4	Northern ....	44	11
Kassala ....	172	58	Upper Nile ....	—	—

The incidence during the last 5 years has been as follows :—

YEAR.	Cases.	Deaths.
1936 ... ..	577	132
1937 ... ..	425	57
1938 ... ..	527	158
1939 ... ..	553	103
1940 ... ..	515	104

446,155 vaccinations were carried out in the Sudan during the year.

The number carried out during the last five years is as follows :—

YEAR.	
1936 ... ..	92,949
1937 ... ..	561,197
1938 ... ..	1,348,694
1939 ... ..	580,052
1940 ... ..	446,155



Cases continued to be reported during the first half of the year along the frontier in the western districts of Darfur Province where the disease had been continuously reintroduced into the Sudan during the previous two years. Intensive vaccination campaigns were again carried out during the cold weather and the disease died out. In the Eastern Sudan a small outbreak occurred in the Red Sea district of Kassala Province and in Northern Province. This was introduced by pilgrims from Arabia Seoudia as for several reasons this year it was impossible to ensure that all returning pilgrims had been effectively vaccinated before departure or to keep them in quarantine for the full period of quarantine. These reasons included the admission to Suakin Quarantine of West African pilgrims who had departed for Arabia from Massawa without return tickets contrary to the International Sanitary Convention and had become destitute there, and the bombing and machine-gunning of the Suakin quarantine while the last batch of pilgrims was in quarantine, injuring four of them, which necessitated their premature release and resulted in small outbreaks of small-pox in Northern Province. The extensive vaccination campaigns of the last five years have resulted in a sufficiently high degree of immunity among the population of the Northern Sudan to prevent any extensive outbreak of the disease in the near future.

### **YELLOW FEVER.**

An extensive outbreak of Yellow Fever broke out in a remote area of the Eastern Jebels District of the Nuba Mountains during the rains. Communications to and in this area are very difficult during the rainy season as the roads are impassable for motor traffic and the aerodromes closed. Consequently it took several weeks to investigate the disease and verify the diagnosis pathologically. Meantime the most stringent measures were taken to prevent the spread of the disease to other parts of the Sudan or neighbouring countries by air, rail, or road. These included for a short while a stoppage of all passenger railway traffic east of Kosti on the White Nile. In the face of great difficulties a team of British and Sudanese medical, public health, and research officials with the assistance of the local Administrative officials, confirmed the diagnosis and took every precaution locally to stamp out the disease. The Sudan is indebted to the Rockefeller Foundation, New York, and to the Wellcome Institute of Scientific Research, London, for supplying vaccine in large quantities at once for dealing with this epidemic. Dr. Rankin, Senior Medical Inspector, Kordofan Province, reports as follows:—

“ An epidemic of Yellow Fever broke out in the Nuba Mountains in the summer of 1940. The disease was localized to the Eastern Jebels district except that Jebel Sheibun on the Eastern border of the Western Jebels was infected.

“ The first news of the epidemic was received on the 20th September. A fuller report on the 6th October showed that the signs and symptoms resembled the clinical picture of Yellow Fever. On the 4th November the diagnosis was confirmed pathologically. Serological confirmation was obtained later and typical Yellow Fever virus was isolated.

“ Considerable difficulty has been experienced in gathering an authentic history of the origin of the outbreak—the Nuba is liable to change his tale from time to time and his memory is often at fault. Investigations by District Commissioner, Eastern Jebels, indicate that the outbreak probably originated in Tira Luman in May. It spread to the Moro in June, to Otoro in mid—July, and to Tira in early September. From Tira the infection moved eastward to Um-Durdu in early October and then on to Errio, Kalacha, Lukha, and Kalogi later in the month. It started in Shawai, Sheibun and Heiban in September. From Heiban it spread slowly north to the Koalib Area. The source of origin of the outbreak in the Tagoi Hills, which



was the most northern limit of the disease, has been more difficult to determine. There are two explanations given : (a) that the infection originated in Tagoi in May and that what may have been sporadic cases occurred there during the rains, or (b) that the infection was brought to the Tagoi Hills in September by people who went south for tobacco, and that the sporadic deaths which occurred in the rains were not due to Yellow Fever.

“ The Nuba Mountains was declared infected but it was decided that a larger area would be subject to restrictions for economic reasons and to facilitate control work. All movement into or out of this area was prohibited. Later, movement through quarantine or after inoculation was permitted. An inner and an outer control were established. The inner control aimed at localising the disease to actual places infected and the outer to ensure that if infection passed the inner lines that the railway, river, and main western routes would be adequately protected. As a further safeguard, travel on the railway eastwards was limited by permit and *Aedes* control measures were extended. With active co-operation of the Local Authorities and the native population our object was achieved. The El Obeid Aerodrome was made anti-amaryl as a precautionary measure and in case the infection spread north and invaded El Obeid.

“ The incidence of Yellow Fever rapidly subsided throughout November and December in all infected areas except the Tagoi Hills. Concomitant with the decrease in the number of cases reported, mosquitoes became less numerous.

“ Entomological data is only available from November. Among the species of *Aedes* found in the southern half of the Area infected were *A. aegypti*, *A. vittatus*, and *A. metallicus*. The *Aedes aegypti* larval index varied from 0-28%. In the Tagoi Hills, the northern extremity of the infected Area, a different picture was seen. A visit there in December revealed water jars in the houses swarming with *Aedes aegypti* larvae—the houses were full of adults—no other species of mosquito was discovered—the *Aedes* index was estimated at 98%.\*

“ Before the new crops were available there was lack of food in the Koalib and Heiban areas and to a lesser extent in Tira, Otoro and Shawai.

“ At Um Gabrallah in the Moro Hills the people were also hungry but the rest of the Moro and Tira Luman, where the infection started, had ample food. In the Koalib and Heiban Areas where the food situation was most acute the incidence of Yellow Fever was lighter than elsewhere. There is therefore no evidence that sub-nutrition contributed to factors influencing the outbreak.

“ Despite the fact that mouse protection tests carried out in recent years indicate that the disease has occurred in various parts of the Nuba Mountains, enquiries have failed to obtain any information of a similar epidemic in the past, except that in 1934 a small outbreak occurred in Ghulfan in which the symptoms were suggestive of Yellow Fever though this was not confirmed. It is possible that the severer symptoms of black vomit, jaundice etc. have been absent and some mild cases have been occurring which were liable to be mistaken for malaria or influenza. Dr. Corkill contracted Yellow Fever in Kau in 1936, but the symptoms he described did not resemble the typical clinical picture of this disease. At Kau, where 80 % of the mouse protection tests were positive no history of Yellow Fever could be elicited.

“ Places where mouse protection tests have been positive must be considered as areas in which cases of Yellow Fever may occur which means that the Sudan, south of a line El Fasher, El Obeid, Kosti, Sennar eastwards should be regarded as an endemic area.

“ Now that the epidemic is over the position is little different to that in previous years. The following steps are being taken to limit the chances of a further outbreak in this Province :—

- (a) It has been agreed that a medical entomologist with the requisite staff should be posted to the Nuba Mountains.
- (b) *Aedes* control work is being extended.
- (c) Propaganda with a view to the education of the people in the practice of changing water in household containers.
- (d) Inoculation of all officials, families, and servants resident in or proceeding to the Nuba Mountains, inoculation of all the non-indigenous population of the Nuba Area, and of the Baggara Arabs when adequate supplies of vaccine are available.

“ A number of Europeans had the disease during this epidemic and mouse protection tests indicate that others must have had it in the past. It is interesting to note that no deaths have occurred in the Nuba Mountains among Europeans from Yellow Fever or any condition resembling Yellow Fever.

“ Appended are the results of some mouse protection tests in Kordofan. Otoro and Tira which were negative (indicating no immunity) suffered severely in this epidemic.

PLACE.							% Immunity.	Age of Youngest Positive.
Talodi	...	...	...	...	...	...	18	3
Otoro ...	...	...	...	...	...	...	—	—
Tira ...	...	...	...	...	...	...	—	—
Shawai Arabs		...	...	...	...	...	—	—
Heiban	...	...	...	...	...	...	10	8
Koalib	...	...	...	...	...	...	10	45
Rashad	...	...	...	...	...	...	—	—
Abbasia	...	...	...	...	...	...	—	—
Gebel Dair	...	...	...	...	...	...	—	—
Kaderu	...	...	...	...	...	...	30	5
Abu Gabeiha		...	...	...	...	...	22	6
Kaka (Shilluks)		...	...	...	...	...	38	11
Gardud	...	...	...	...	...	...	10	18
Kau ...	...	...	...	...	...	...	80	4
Nyara	...	...	...	...	...	...	65	17
Fungor	...	...	...	...	...	...	80	5
Kilogi	...	...	...	...	...	...	9	19
Moro ...	...	...	...	...	...	...	20	30
Um Dorein	...	...	...	...	...	...	30	8
Buram	...	...	...	...	...	...	70	9
Eliri	...	...	...	...	...	...	44	?
Kadugli	...	...	...	...	...	...	12	18
Keiga ...	...	...	...	...	...	...	80	4
Ghulfan	...	...	...	...	...	...	24	?
Gulud	...	...	...	...	...	...	20	23
Dilling	...	...	...	...	...	...	23	30
Katla ...	...	...	...	...	...	...	—	—
Sabai	...	...	...	...	...	...	40	28

“ It is unlikely that next year there will be a recrudescence of the epidemic in the areas severely affected in 1940 as immunity rate in these places must be comparatively high.



Considerable difficulty was encountered in making an estimate of the incidence of Yellow Fever. Many cases were mild—and people were liable to forget that they had been ill when enquiries were made at a later date. The following table shows the approximate number of cases and deaths. Where it was possible to work out the mortality rate with any degree of certainty it was estimated to be about 10%.

PLACE.							Population	Cases	Deaths
Moro	...	...	...	...	...	...	20,000	4,970	548
Otoro	...	...	...	...	...	...	} 45,000	4,718	476
Tira	...	...	...	...	...	...		3,726	328
Shawai	...	...	...	...	...	...	} 37,000	302	30
Heiban	...	...	...	...	...	...		364	89
Koalib	...	...	...	...	...	...		64	4
Kilogi	...	...	...	...	...	...	7,000	788	65
Sheibun	...	...	...	...	...	...	2,000	330	35
Tagoi*	...	...	...	...	...	...	1,200	366	50
Talodi	...	...	...	...	...	...	12,500	5	2
TOTAL ... ..							124700	15,633	1,627

\* Since this report was written it has been revealed that during the period under review there were cases of relapsing fever occurring in the Tagoi area and it is probable that some of the cases and deaths recorded were attributable to this disease and not to Yellow Fever.

## ENDEMIC DISEASES.

### ANCYLOSTOMIASIS.

This disease is of no public health importance in the Northern Sudan although it occurs in a few small isolated areas in Northern Province, but is a more serious problem and a cause of hospitalisation in parts of Equatoria Province. It is particularly prevalent and virulent in Rumbek District where local conditions, almost impossible to remedy, favour its spread. The experiment of providing shoes in Rumbek Area proved a failure. Some 400 natives were examined and treated and half given shoes. The intention was to re-examine the two groups after six months but the Dinkas wore their shoes around their necks instead of on their feet.

### BILHARZIASIS.

The incidence of this disease remains negligible in the Northern Sudan but it is only by constant effort and drastic preventive measures that this satisfactory state of affairs is maintained.

#### GEZIRA PROVINCE.

##### Irrigated Area of the Gezira. *Schistosoma haematobium*.

The following table shows the incidence of the disease among the indigenous population of the irrigated area of the Gezira since 1926 :—

YEAR.	ADULTS.			CHILDREN.			TOTAL.		
	No. Exmd.	No. Infld.	%	No. Exmd.	No. Infld.	%	No. Exmd.	No. Infld.	%
1926 ....	16,419	76	0.47	—	—	—	16,419	76	0.47
1929 ....	—	—	—	2,341	37	1.60	2,341	37	1.60
1930 ....	—	—	—	3,322	20	0.57	3,322	20	0.57
1931 ....	11,102	84	0.75	6,895	51	0.74	17,997	135	0.75
1932 ....	9,618	51	0.53	1,707	19	1.10	11,325	70	0.62
1933 ....	14,188	28	0.20	3,288	27	0.82	17,476	55	0.31
1934 ....	12,769	5	0.04	3,583	2	0.07	16,352	7	0.04
1935 ....	13,902	8	0.06	2,945	12	0.40	16,847	20	0.12
1936 ....	22,604	10	0.04	5,483	17	0.31	28,087	27	0.09
1937 ....	30,768	26	0.08	10,038	63	0.62	40,806	89	0.22
1938 ....	32,045	50	0.15	16,916	162	0.95	48,961	212	0.43
1939 ....	17,044	30	0.17	10,877	174	1.50	27,921	204	0.73
1940 ....	29,711	64	0.21	12,310	109	0.87	42,021	173	0.41

The annual surveys have been carried out in exactly the same way by different observers since 1931 and the results show that there is no appreciable increase in the incidence of Bilharziasis in this area. The average percentage figures for adults and children since 1931 is .22 and .72 respectively. The figures for the routine examinations of 1940 for adults and children are 0.21 and 0.87 respectively.



**WHITE NILE AREA.**

A survey was carried out in the White Nile area with the following results :—

District	Bilharzia haematobium			Bilharzia mansoni.		
	No. Exmd.	No. Inftd.	%	No. Exmd.	No. Inftd.	%
Dueim ... ..	2,021	52	2.5	2,242	277	12.3
Kosti ... ..	2,004	109	5.4	1,826	22	1.2
	4025	161		4068	299	

**NORTHERN PROVINCE.**

**Dongola and Merowe Districts. Schistosoma haematobium.**

The comparative figures for the last twelve years from the annual survey are as follows :—

Year.	Number examined	Infections found.	Percentage	Year.	Number examined	Infections found.	Percentage
1929 ....	17,925	2,187	12.2	1935 ....	40,950	1,408	3.4
1930 ....	26,094	2,443	9.3	1936 ....	37,334	1,268	3.4
1931 .....	37,405	1,765	4.6	1937 ....	46,741	1,155	2.5
1932 ....	49,077	2,470	5.0	1938 ....	44,517	891	2.0
1933 ....	58,711	1,825	3.1	1939 ....	40,194	1,054	2.6
1934 ....	46,054	1,768	3.8	1940 ....	35,205	1,107	3.1

The importance of Bilharziasis to the public health of this area has gradually diminished since 1928 when yearly surveys and treatment commenced. Formerly this disease was a major cause of hospitalization and illness but now owing to early diagnosis cases are so slight that treatment is not sought and most infected persons do not know they have the disease until diagnosed during the yearly routine examinations of the population.

**Wadi Halfa District. Schistosoma haematobium.**

The yearly survey shows the following comparative figures :—

Year.	Number examined.	Infections found.	Percentage	Year.	Number examined.	Infections found.	Percentage
1935 ....	12,076	2,613	21.6	1938 ....	21,958	2,763	12.5
1936 ....	12,437	1,439	12.9	1939 ....	18,319	2,422	13.1
1937 ....	18,498	2,002	10.8	1940 ....	16,064	2,435	15.1

**Berber and Shendi Districts. Schistosoma haematobium.**

500 infections were found out of 8000 examinations carried out in this area, and incidence of 6.25%. It is worth noting that the incidence in 1926 in the Berber area was 60-80% of all examined.

EQUATORIA PROVINCE.

Schistosoma mansoni is prevalent in the part of the province lying west of the Nile.

Schistosoma haematobium.

The disease has died out at Qala En Nahl where ponds became infected three years ago and special measures had to be taken to deal with the situation.

BLACKWATER FEVER.

24 cases were reported with 9 deaths.

The figures for the last six years are as follows :—

YEAR.	Cases.	Deaths.	Year.	Cases.	Deaths.
1935 ....	18	9	1938 ....	29	8
1936 ....	38	14	1939 ....	20	7
1937 ....	20	5	1940 ....	24	9

The nationalities affected were :—

	Cases	Deaths.
Sudanese Arab ... ..	14	4
Sudanese Negroid ... ..	—	—
Greek ... ..	4	2
Italian ... ..	2	—
Egyptian ... ..	1	1
British ... ..	1	1
West African ... ..	1	1
Armenian ... ..	1	—
	24	9

The following table shows the incidence of age and sex in the various areas :—

PROVINCE	DISTRICT	MALE		FEMALE		AGE GROUPS.							
		A	D	A	D	0-1	1-5	5-15	15-25	25-35	35-45	45-65	65 and over
Equatoria	Juba ....	4	—	1	1	—	—	1	1	2	1	—	—
	Yei ....	1	—	1	1	—	—	—	—	1	1	—	—
	Torit ....	2	1	—	—	—	—	—	—	1	—	1	—
	Kapoeta ....	1	—	—	—	—	—	—	1	—	—	—	—
Gezira	Gezira ....	2	—	—	—	—	—	—	1	—	1	—	—
	White Nile	2	1	—	—	—	—	—	—	—	—	2	—
	Fung ....	2	1	—	—	—	—	—	—	1	—	1	—
Khartoum	Khartoum North ....	1	—	—	—	—	—	—	—	1	—	—	—
	El Obeid....	1	—	—	—	—	—	—	—	1	—	—	—
Kordofan	Dilling ....	1	1	—	—	—	—	—	—	—	—	1	—
	Um Ruaba	1	1	—	—	—	—	—	—	—	1	—	—
Upper Nile	Malakal ....	3	2	1	—	—	—	—	—	2	1	1	—
TOTAL ....		21	7	3	2	—	—	1	3	9	5	6	—
DEATHS ....		—	—	—	—	—	—	1	—	1	3	4	—



## DRACONTIASIS.

This disease is endemic in parts of the Southern Sudan and the Nuba Mountains district of Kordofan Province. Efforts made to reduce the incidence by improving the water supply appear to be having an effect in Equatoria Province.

PROVINCE.				Cases. Treated.	PROVINCE.				Cases. Treated.
Darfur ....	....	....	....	11	Khartoum ....	....	....	....	8
Equatoria ....	....	....	....	1,362	Kordofan ....	....	....	....	615
Gezira ....	....	....	....	19	Northern ....	....	....	....	6
Kassala ....	....	....	....	15	Upper Nile ....	....	....	....	47
TOTAL ....				....	....	....	....	....	2,083

## DYSENTERY.

3,280 cases were admitted to hospital of which 3,008 were diagnosed as amoebic and 272 as bacillary dysentery. The sudden introduction of a large number of carriers and susceptibles from outside the Sudan living under improvised sanitary conditions in the field account for the rise in incidence of bacillary dysentery.

The following table shows the admissions to hospital given as the percentage of the total admissions from all causes for 1940 and the previous nine years.

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Amoebic Dysentery ....	3.28	2.51	3.25	3.00	2.83	2.49	2.48	2.76	3.18	2.88.
Bacillary Dysentery ....	0.41	0.41	0.38	0.28	0.26	0.18	0.13	0.13	0.17	0.26
TOTAL ....	3.69	2.92	3.63	3.28	3.09	2.67	2.61	2.89	3.35	3.14

## ENTERIC FEVER.

336 cases of Typhoid and Paratyphoid fevers were reported with 39 deaths.

The following table shows the incidence of this disease during the last ten years:—

1931 ....	100	1936 ....	135
1932 ....	85	1937 ....	165
1933 ....	204	1938 ....	213
1934 ....	188	1939 ....	202
1935 ....	246	1940 ....	336

The incidence in Omdurman was higher than usual. In September 141 locally contracted and 16 imported cases were reported. No specific reason for this increase could be traced.

## HYDATID DISEASE.

11 cases were reported from the small endemic centre of Kapoeta in eastern Equatoria Province compared with 13 in 1939, 19 in 1938 and 26 in 1937.



## LEISHMANIASIS.

460 cases were reported with 83 deaths. The incidence during the last ten years has been as follows :—

YEAR.	Cases.	YEAR.	Cases.
1931 ....	84	1936 ....	214
1932 ....	103	1937 ....	336
1933 ....	202	1938 ....	295
1934 ....	289	1939 ....	394
1935 ....	171	1940 ....	460

## KALA-AZAR

446 cases were reported with 82 deaths. Extensive investigations have been carried out regarding the etiology and treatment of this disease which account for the apparent increase in incidence. Cases are reporting more readily from remote areas as news of more effective treatment reaches them. New drugs produced by the research workers of the Liverpool School of Tropical Medicine were closely investigated with satisfactory results, the mortality being reduced by half. In the past the treatment of this disease in the Sudan has always been unsatisfactory as it is far more resistant to antimony than is found to be the case in other countries. The endemic area remains the same along the whole length of the Abyssinian border.

### GEZIRA PROVINCE.

Kala-azar is endemic in the whole of the Fung Area where 229 cases were reported compared with 134 in 1939. Gland puncture was found to be a useful diagnostic procedure. Dr. Sati, Medical Officer, Singa, reports as follows on the use of new drugs :—

“ The experimentation on treatment of Kala-azar with the new drugs (M and B 744, M and B 800 and M and B 782) shows encouraging results.

Drugs.	Cures	Deaths	Total
M and B. 744 ... ..	25	3	28
M and B. 800 ... ..	12	2	14
M and B. 782 ... ..	1	—	1

### EQUATORIA.

#### Kapoeta District.

35 cases of Kala Azar were admitted to hospital compared with 72 in 1939, and 83 in 1938. The geographical distribution remains the same.

### KASSALA PROVINCE.

125 cases were admitted compared with 47 in 1939.

There has been a considerable increase in the number of cases admitted to Gedaref Hospital probably accounted for by the intensive investigations which were carried out in this district.

### UPPER NILE PROVINCE.

Only one locally infected case was reported during the year compared with 46 in 1939 and the epidemic amongst the Paloic Dinka has died out.

DISTRIBUTION.

Province.	District.	MALE		FEMALE		A G E G R O U P S							
		A	D	A	D	0-1	1-5	5-15	15-25	25-35	35-45	45-65	65 and over
Darfur	Darfur	10	4	3	2	—	—	8	1	2	—	1	1
Equatoria	Juba	2	—	—	—	—	—	—	—	1	1	—	—
	Torit	2	—	—	—	—	—	—	1	1	—	—	—
	Kapoeta	22	—	13	—	—	6	16	6	7	—	—	—
Gezira	Gezira	18	6	1	—	—	1	3	8	4	3	—	—
	White Nile	1	1	—	—	—	—	—	—	—	1	—	—
	Fung	186	31	43	10	—	10	84	56	44	27	8	—
Kassala	Port Sudan	3	—	—	—	—	—	1	—	1	1	—	—
	Gedaref	89	19	36	6	—	10	33	39	23	15	5	—
Khartoum	Khartoum	8	1	—	—	—	—	—	3	4	1	—	—
	Omdurman	6	1	—	—	—	—	2	1	2	1	—	—
Kordofan	El Obeid	2	—	—	—	—	—	1	—	1	—	—	—
	Nuba Mts.	8	1	1	—	—	—	4	4	—	1	—	—
Northern	Atbara	3	1	—	—	—	—	1	1	1	—	—	—
	Merowe	1	—	—	—	—	—	—	—	—	1	—	—
Upper Nile	Malakal	2	—	—	—	—	—	1	—	1	—	—	—
TOTAL	....	363	65	97	18	—	27	154	120	92	52	14	1
DEATHS	....	....	....	....	....	—	4	31	15	19	10	3	1

RACE.

The races affected were :—

Sudanese (Arab)	....	....	....	290	Greek	....	....	....	....	1
Sudanese (Negroid)	....	....	....	104	Eritreans	....	....	....	....	2
West Africans	....	....	....	49	Yemenis	....	....	....	....	1
Abyssinians	....	....	....	13						

RESULTS OF TREATMENT.

				Apparently cured	Died.	Still under	Untreated or lost
				%	%	treatment %	sight of %.
1937	....	....	....	37	17	28	18
1938	....	....	....	35.6	18.3	18.7	27.4
1939	....	....	....	42.1	26.4	21.1	10.4
1940	....	....	....	58.7	18.0	12.2	11.1

ESPUNDIA.

4 cases were reported during the year including 3 from the Fung Area and 1 from Khartoum.

CUTANEOUS LEISHMANIASIS.

10 cases were reported of which 9 were from Kordofan and 1 from Darfur Province.



## LEPROSY.

The following table shows the distribution of lepers under observation in the Sudan :

Province	Under treatment in camps or settlements.	Under observation and treatment as hospital or dispensary outpatients.	Total under treatment.	Under observation but not under treatment.	Total cases.
Darfur	—	7	7	—	7
Equatoria	996	311	1,307	2,330	3,637
Gezira	58	8	66	20	86
Kassala	25	—	25	—	25
Khartoum	25	—	25	8	33
Kordofan	98	8	106	1,886	1,992
Northern	—	7	7	50	57
Upper Nile	35	16	51	—	51
<b>TOTAL</b>	<b>1,237</b>	<b>357</b>	<b>1,594</b>	<b>4,294</b>	<b>5,888</b>

The estimated number of lepers in the Sudan is approximately 8,000.

### NORTHERN SUDAN.

The incidence is very low and the few cases which occur are treated by isolation in their own houses where possible. Special accommodation is constructed which enables them to live apart while still being able to feel that they are an integral part of the family. The small settlement at Gedaref still serves a useful purpose in catering for those who cannot be dealt with by isolation at home.

### CENTRAL SUDAN.

The small leper settlements sited near dispensaries in this area are proving adequate. The incidence is considerably higher than in the Northern Sudan but not high enough to justify the large independent settlements of the Southern Sudan. Treatment is entirely voluntary. The people are very wild in many areas and there is sometimes difficulty in persuading the lepers to remain in the settlements. However the advantages of better accommodation, treatment, and food are a distinct attraction.

### SOUTHERN SUDAN.

The incidence remains very high in many parts of the Southern Sudan, but it has been possible to reduce the numbers in the Li Rangu and Source Yubu settlements considerably by decentralising treatment and supervision to dispensaries near the patient's home wherever possible.

#### Li Rangu Leper Settlement.

Dr. J. F. E. Bloss, Senior Medical Inspector, Li Rangu, reports as follows :—

“During the year the problem of keeping useful, and reasonable accurate statistics of lepers in this area has been reviewed. The new method is exemplified in the table allotted to this report. It is hoped to be able to extend this to all lepers in the District. But it must be emphasised that these figures at their best are only approximately accurate. All cases on record have been reviewed, and it is estimated that there are about 2,500 lepers in the Yambio district. The total population for this district is estimated at between 65,000 and 70,000. The leprosy incidence is thus about four per cent, probably one of the highest in the world. It is likely to remain high until the general standard of education is raised, and the attitude of the people to the disease is altered.



"Table I shews the total and types of new cases this year. There is again a large increase. It is doubtful if this is a true increase. Table II shews the total number of lepers. Appendix No. 8 shews the distribution of these lepers throughout the district. The total number of lepers, including new cases is less than last year. The reason is that all old cases that have not been seen for the last six years have been deleted from the registers, as well as all doubtful cases, and cases which have been clear for five or more years and can be regarded as cures. The number of leper absentees from inspections outside is approximately the same as the number of new cases recorded. This is specially noted with regard to the women lepers. In all new cases, and old cases, care is now being taken to record names of the guardian and next of kin, so as to ensure that these cases can be more easily traced in future years. In the past, new lepers once recorded, not infrequently changed their name and abode and were not seen again. If they were seen again in their new abode they would be naturally recorded as new cases. It is hoped to avoid such errors in the future, but the ingenuity of the native to escape detection is so great that errors are bound to occur. In Li Rangu settlement, where supervision of lepers is stricter, the number of absentees is less than 3% while among outside cases it is over 20% of all cases. Table IV shews the lepers in the settlement according to their type, and the progress of the cases.

Table V gives similar figures for the out lepers.

"The bacteriological examination of lepers has continued. It must be pointed out that cases are examined only if there is any change in their condition. All new cases are examined. The classification of cases depends largely on the bacteriological examination. Tuberculoid cases, which are common, are classified as cutaneous or neural according to whether they are positive or negative. Classification, is as far as possible according to the latest standards, except that the term 'cutaneous' is still employed for the more modern terminology 'lepomatous.' Tuberculoid cases are common. Bad nodular cases, or mutilated cases are rarely seen as new cases, or as complications of old cases.

"In the settlement, it is the rule rather than the exception for new cases to give some family history of leprosy. In outside cases it is impossible to find the probable or possible source of infection in the great majority of cases.

#### (a) In Lepers.

"During the year 299 lepers, and 917 civilians were discharged from Li Rangu. The settlement population—Table III—is now 956 lepers and 2228 civilians. A further 120 lepers and 290 civilians are to be discharged next year. The residue of lepers will be all under treatment, and most of them are positive bacteriologically. Any further large reductions in the settlement will not be possible until these cases have become quiescent. 59.8% of these remaining in the settlement are positive for lepra bacilli.

"The small mud dispensaries have been built in the settlement so that lepers who live far from the hospital need not come in for their injections. The dressers trained to do these injections, will, it is hoped, be sent out later to assist in the treatment of lepers at outside dispensaries. Treatment was started this year with alepol, and later replaced with the pure hydnocarpus wightmania oil, as soon as this was available.

#### (b) Segregated Lepers.

"The Napasi segregation camp for highly infective lepers was opened in February this year. It consists of eight blocks each containing about twenty five huts, as well as dressers huts. The total number in the segregation at present is 211. Two good latrines, and three wells have been constructed. 186 cases were examined for



bilharzia and ankylostoma and 36 positive for bilharzia, and 147 positive for ancylostoma were treated. At the end of three months another examination was made only 4 were found to be still positive for bilharzia, and 23 for ancylostoma. Half rations are given to the lepers in this camp. The rations are distributed daily through the week, as well as salt and oil, and all cases have been under treatment with hydnocarpus oil injections and also for a short period, alepol injections.

"This new site and arrangement for the segregation camp has so far been very satisfactory. Fewer lepers have deserted from this camp this year (23 out of 211, instead of over forty out of 160 in the last site). A well equipped dispensary with two small wards for special cases is in the centre and treatment for all various ailments of these cases has been facilitated. During the eleven months there have been a total of 5499 attendances, excluding the weekly injections of all cases.

"It will be appreciated that very few of these cases, if any, can hope for a cure. Most of them will be chronic cases, highly infective for many years. Even so it is really remarkable to see the improvements in their general condition, and they are all much happier than previously.

"The provision of wells and latrines will make it possible to keep these cases comparatively free from bilharzia and hookworm, diseases which are so common in this district. Each year small improvements will be made, such as the planting of more trees, the provision of spindles to facilitate the drawing of water from the wells, extension of private and small communal cultivations for the camp, and small grain stores for each hut. The cost of upkeep for this camp will be comparatively heavy as most of the huts will have to be replaced each year. It is hoped to sow grass in all blocks and improve the appearance of the roads, and also to provide a small school-church for the cases. All the dressers and terebais (police) in the camp are chosen from the people there. The relatives of those in the camp live on a road about half a mile away, so that they are near enough to be able to help if necessary, while not so near as to encourage too much mixing. Neither the staff nor the money are available to make this camp as ideal as might be wished. Indeed if such an ideal could be obtained, there would be so many restrictions that it would be very unpopular, and most of the cases would desert. The present arrangement is probably the best that can be hoped for yet.

#### (c) Out Lepers.

"The number of old cases that continue to be absent from inspections is rather alarming. It is hoped to reduce this next year. The institution of a census makes it possible to keep a better check on cases and also to ensure that such new cases as are found were seen during the previous year. In one area an out leper sub-chiefship was started this year. The sub-chief was an old leper discharged from Li Rangu. Incidentally he was the first leper registered in this area. A small dispensary and dresser provide treatment for cases. It is hoped next year to institute increased treatment for leprosy among his subjects. As more and more cases are discharged from Li Rangu, so the out treatment of cases will have to increase. This sub-chief has 68 lepers among his subjects. Most of them are arrested, or cured, discharged from Li Rangu, but 12 have been recommended for further courses of treatment at the dispensary. It may be possible to start similar dispensaries in other areas. This would be ideal for the district, but until the chiefs, themselves, understand and cooperate more in leprosy work it would not be satisfactory. A few chiefs have visited Li Rangu specially to see the new segregation camp, and any who have passed through have been taken over. On all possible occasions the many and varied problems of leprosy in this district have been discussed with the chiefs. Progress is being made, but it will be rather slow."



TABLE I.

NEW CASES 1940.

TYPE	OUT LEPERS				IN LEPERS				TOTAL Cases.
	M	W	B	G	M	W	B	G	
C <sub>1</sub> ... ..	15	5	2	—	—	—	—	1	23
C <sub>2</sub> ... ..	2	—	—	—	—	—	—	—	2
N <sub>1</sub> ... ..	90	56	16	8	4	6	4	5	189
N <sub>2</sub> ... ..	2	—	—	—	—	—	—	—	2
C <sub>1</sub> N <sub>1</sub> ... ..	14	4	1	—	—	—	1	—	20
C <sub>1</sub> N <sub>2</sub> ... ..	2	—	—	—	—	—	—	—	2
C <sub>2</sub> N <sub>1</sub> ... ..	3	—	—	—	—	—	—	—	3
1940 ... ..	128	65	19	8	4	6	5	6	241
1939 ... ..	132	70	10	7	11	20	6	5	261

TABLE II.

TOTAL LEPERS : LI RANGU DISTRICT.

	M.	W.	B.	G.	TOTAL
Out lepers ... ..	901	440	90	27	1,458
Non Segregated In Lepers ...	425	284	24	11	744
Segregated In Lepers ...	150	55	6	1	212
TOTAL ...	1,476	779	120	39	2,414
Estimated other cases ... ..	...	...	...	...	86
Total for district (Estimated) ... ..	...	...	...	...	2,500

TABLE III.

POPULATION, LI RANGU SETTLEMENT, 1939-1940.

	LEPERS				CIVILIANS				TOTAL
	M	W	B	G	M	W	B	G	
1939 ... ..	798	503	32	9	771	1,059	543	382	4,097
1940 ... ..	575	339	30	12	678	836	401	313	3,184

TABLE IV.

LEPERS IN LI RANGU SETTLEMENT.

	New	Under Treatment	Cured	Improved	Stationary	Worse	Admitted	Discharged	Deserted	Died	Absentees not Seen	Total Cases	Total Remaining
C <sub>1</sub> ...	1	35	6	17	20	22	3	20	8	—	3	97	71
C <sub>2</sub> ...	—	16	—	8	—	6	2	4	6	1	2	29	19
C <sub>3</sub> ...	—	9	—	2	2	1	—	—	1	1	4	11	9
N <sub>1</sub> ...	19	12	93	64	159	42	—	212	36	4	7	636	384
N <sub>2</sub> ...	—	7	1	8	33	9	—	25	8	—	—	84	51
N <sub>3</sub> ...	—	11	—	1	20	8	—	14	3	1	3	50	32
C <sub>1</sub> N <sub>1</sub>	1	20	—	18	25	21	3	13	6	1	1	89	69
C <sub>1</sub> N <sub>2</sub>	—	29	—	14	30	41	2	6	6	2	3	104	90
C <sub>1</sub> N <sub>3</sub>	—	33	—	13	19	19	—	3	1	2	1	58	52
C <sub>2</sub> N <sub>1</sub>	—	20	—	5	4	12	—	1	—	—	7	29	28
C <sub>2</sub> N <sub>2</sub>	—	37	—	13	11	17	—	1	1	1	3	47	44
C <sub>2</sub> N <sub>3</sub>	—	53	—	9	21	21	—	—	1	3	2	57	53
C <sub>3</sub> N <sub>1</sub>	—	15	—	3	7	2	—	—	—	1	3	16	15
C <sub>3</sub> N <sub>2</sub>	—	27	—	7	8	10	—	—	—	3	2	30	27
C <sub>3</sub> N <sub>3</sub>	—	12	—	2	2	—	—	—	—	—	—	10	12
TOTAL	21	335	100	184	361	239	10	299	77	20	41	1,347	956

**TABLE V.**  
**OUT LEPERS, YAMBIO SUB-DISTRICT.**

		New	Under Treatment	Cured	Improved	Stationary	Worse	Admitted	Discharged	Deserted	Died	Absentees not Seen	Total Cases	Total Remaining.
C <sub>1</sub>	...	22	—	123	38	19	12	3	—	—	—	117	—	331
C <sub>2</sub>	...	2	—	14	5	3	3	2	—	—	—	20	—	47
C <sub>3</sub>	...	—	—	—	2	—	—	—	—	—	—	4	—	6
N <sub>1</sub>	...	170	—	265	124	80	60	—	—	—	—	196	—	895
N <sub>2</sub>	...	2	—	2	4	4	—	—	—	—	—	20	—	32
N <sub>3</sub>	...	—	—	—	—	—	—	—	—	—	—	2	—	2
C <sub>1</sub>	N <sub>1</sub>	19	—	14	6	1	4	3	—	—	—	28	—	72
C <sub>1</sub>	N <sub>2</sub>	2	—	—	2	—	—	2	—	—	—	3	—	7
C <sub>1</sub>	N <sub>3</sub>	—	—	—	—	—	—	—	—	—	—	—	—	—
C <sub>2</sub>	N <sub>1</sub>	3	—	5	6	7	8	—	—	—	—	16	—	45
C <sub>2</sub>	N <sub>2</sub>	—	—	1	1	—	—	—	—	—	—	13	—	15
C <sub>2</sub>	N <sub>3</sub>	—	—	—	—	—	—	—	—	—	—	—	—	—
C <sub>3</sub>	N <sub>1</sub>	—	—	2	—	—	—	—	—	—	—	—	—	2
C <sub>3</sub>	N <sub>2</sub>	—	—	—	—	1	—	—	—	—	—	3	—	4
C <sub>3</sub>	N <sub>3</sub>	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL ...		220	—	426	188	155	87	10	—	—	—	422	—	1,458

#### GENERAL.

The incidence shows no sign of increasing in any area and is probably slowly declining in the Sudan as a whole with the continual improvement in public health and standard of living.

#### MALARIA.

9545 cases were admitted to hospital with 45 deaths compared with 9128 and 78 deaths in 1939. Exceptionally favourable climatic conditions prevailed in the Northern Sudan throughout the year.

#### GEZIRA PROVINCE.

The incidence showed a marked reduction, in large measure due to the decreased rainfall but, in addition, to the anti-malarial measures which were intensified in order to achieve as high a standard of public health as possible during the war.



GEZIRA AREA.	1939		1940	
	Cases	Deaths	Cases.	Deaths
Hospital inpatients	1,017	10	620	5
Hospital outpatients	1,369	—	821	—
Dispensary outpatients	25,496	—	14,009	—

Malignant Tertian Malaria is the prevailing infection and the figures of the various types found on microscopic examination were as follows :—

Malignant Tertian  
609

Benign Tertian  
183

Quartan  
35

#### NORTHERN PROVINCE.

The incidence has remained low throughout the Province as a whole although a slight increase was reported in the Atbara district.

#### GENERAL.

Special efforts are being made to keep this disease under control in the war areas at the present time, as practically every previous campaign in tropical Africa has been seriously handicapped by enormous wastage due to it, but it is only by constant supervision that it is possible to keep even the urban districts clear of the disease.

The following table shows the spleen rate of children examined in intermediate and village schools during the last three years. In the Northern Sudan these figures provide a fairly accurate index of the endemicity of malaria but in the Southern Provinces of Equatoria and Upper Nile where schools are few and where the children are to some extent living under protective conditions the spleen rate does not indicate the incidence of malaria which is high throughout the year :—

% Spleen Rate			PROVINCE AND DISTRICT.	TYPE OF PARASITE, 1940		
1938	1939	1940		% Benign	% Malignant	% Quartan
50.1	45.2	36.4	DARFUR PROVINCE	17.8	79.2	3.0
22.6	29.2	13.9	EQUATORIA PROVINCE.			
—	38.4	27.4	Central District	20.5	79.5	—
—	16.5	29.4	Western District	6.4	91.2	2.4
			Zande District	8.6	91.4	—
25.9	26.7	14.8	GEZIRA PROVINCE.			
44.7	32.5	17.7	Blue Nile	21.6	71.8	6.6
50.3	46.4	35.8	White Nile	28.6	71.1	0.3
			Fung	40.1	59.3	0.6
8.5	9.6	0.9	KASSALA PROVINCE.			
22.7	19.5	47.2	Port Sudan	45.0	43.3	11.7
			Kassala	11.5	88.5	—
2.5	6.6	3.5	KHARTOUM PROVINCE	20.6	74.4	5.0
44.1	37.9	32.7	KORDOFAN PROVINCE	30.6	67.6	1.8
3.9	1.9	3.1	NORTHERN PROVINCE.			
15.6	18.9	16.8	Wadi Halfa	30.0	70.0	—
13.2	9.0	10.1	Dongola	61.5	38.5	—
			Berber	20.6	79.4	—
32.1	32.3	20.8	UPPER NILE PROVINCE	8.4	89.9	1.7

## RABIES.

The following figures show the incidence during the last nine years :—

YEAR.					Number of persons receiving treatment.	Deaths despite treatment.	Total. deaths.
1932	....	....	....	....	226	4	8
1933	....	....	....	....	75	6	12
1934	....	....	....	....	198	6	8
1935	....	....	....	....	290	4	10
1936	....	....	....	....	373	1	8
1937	....	....	....	....	534	6	11
1938	....	....	....	....	557	1	8
1939	....	....	....	....	422	8	16
1940	....	....	....	....	352	1	3

All those treated had been bitten.

The biting animals were as follows :—

Dogs	Donkeys	Cats	Calf	Camels	Monkey	Horses
343	2	1	1	1	1	3

The following data is available as regards the fatal cases :

Locality.	Age.	Sex.	Biting Animal.	Site of Bite.	Severity of Bite.	No. of days after bite when treatment was begun.	No. of Injec- tions given.	No. of days from bite to fatal termina- tion.
(a) THOSE TREATED.								
Kordofan	6	Male	Dog	R. Arm	Superficial	30	2	32
(b) THOSE NOT TREATED.								
Kordofan	8	Male	Dog	L. Fore Arm	Deep	—	—	81
..	40	Female	„	L. Leg	Moderate	—	—	38

## ACUTE RHEUMATISM.

223 cases were reported with 3 deaths compared with 303 with 4 deaths in 1939 and 292 with 4 deaths in 1938.

The distribution of cases was as follows :—

PROVINCE.			Cases.	Deaths.	PROVINCE.			Cases.	Deaths.
Darfur	....	....	1	—	Khartoum	....	....	48	—
Equatoria	....	....	40	—	Kordofan	....	....	26	—
Gezira	....	....	24	1	Northern	....	....	37	—
Kassala	....	....	46	2	Upper Nile	....	....	1	—



## SCURVY.

65 cases with 4 deaths were reported compared with 189 cases with 7 deaths in 1939.

## SLEEPING SICKNESS.

81 cases were reported in Equatoria Province compared with 109 in 1939. Of these 80 occurred in the western part of the Zande District and one imported case was found at Juba. No cases were reported from Kajo Kaji where 6 cases occurred in 1939.

The incidence during the last ten years has been as follows :—

YEAR.			Yubu	Yambio.	Yei.	Kajo-Kaji.	Imported.
1931	....	....	61	1	—	—	—
1932	....	....	49	14	—	—	—
1933	....	....	70	12	1	—	—
1934	....	....	20	2	4	6	—
1935	....	....	80	—	1	10	—
1936	....	....	142	—	—	8	—
1937	....	....	63	1	2	23	—
1938	....	....	106	—	—	4	—
1939	....	....	103	—	—	6	—
1940	....	....	80	—	—	—	1

326,682 palpations were carried out during the year and 2,121 gland punctures were performed.

### Zande District.

Dr. Hunt, Senior Medical Inspector, Yubu, reports as follows on the progress of the Block System of Tsetse Fly Control, and conclusions :—

“ 1. There has been a decrease in sleeping sickness this year. The reduction is due to fewer cases in the Yubu River area. This reduction in this area is due to the establishment of the Block Clearing System of tsetse fly control.

“ 2. This system of fly control continues to reduce the fly density in the areas in which it has been extended, and to maintain a low density of fly in areas in which it has been established for the last two years.

“ 3. By maintaining a low fly density it is possible to eliminate sleeping sickness in the course of time.

“ 4. What is also important is that provided a low fly density can be maintained, it is possible to allow the people to build their houses where they wish, and to make their cultivations under more favourable conditions. Fewer restrictions are necessary on their habits, customs, and mode of living.

5. The further extension of the scheme to the other river systems is advocated in the future, as soon as conditions become more favourable.

**BLOCK SYSTEM STAFF.**

Sanitary Overseers	...	...	...	...	...	...	...	3
Group Leaders	...	...	...	...	...	...	...	5
Section Leaders	...	...	...	...	...	...	...	25
Fly Boys	...	...	...	...	...	...	...	215
Terabais	...	...	...	...	...	...	...	3

**NUMBER OF TESTSE FLIES CAUGHT** — 79,021

Male	...	...	...	...	...	...	...	...	35,074
Female	...	...	...	...	...	...	...	...	43,947

**VENEREAL DISEASES.**

**SYPHILIS.**

The incidence of this disease is high, particularly in the Eastern and Western Sudan. Fortunately the Sudanese suffer in a very mild form and the more serious complications are rarely seen.

**GONORRHOEA.**

This is a serious public health problem. Treatment with the sulphonamide group of drugs has proved of considerable value.

**YAWS.**

This disease is now restricted to a few remote southern districts and is of no public health importance.

**TUBERCULOSIS.**

1,036 cases were admitted to hospital of whom 579 were pulmonary and 457 non-pulmonary.

Wadi Halfa and Dongola districts continue to furnish many cases. This disease is a serious public health problem and there is every reason to expect an increase of incidence from the unsettled conditions and lack of food in the Eastern Sudan resulting from enemy occupation. It is hoped that in the Sudan as a whole the gradual raising of the standard of living will compensate for the increasing chances of infection from outside the Sudan, but the whole question will require very careful review after the war. Contacts are regularly examined in Khartoum and other towns.

49 of the pulmonary cases were foreigners and 4 were Sudanese who had contracted the disease in Egypt.

							Pulmonary	Non-pulmonary.
West Africans	....	....	....	....	....	....	29	33
Egyptians	....	....	....	....	....	....	4	1
Eritreans	....	....	....	....	....	....	5	6
Abyssinians	....	....	....	....	....	....	5	5
Yemenis	....	....	....	....	....	....	4	—
Somalis	....	....	....	....	....	....	1	—
Italians	....	....	....	....	....	....	1	—
							49	45



The following table shows the admissions and percentage rate of tuberculosis to other admissions for the Northern and Southern Sudan for the last four years :—

				1937		1938		1939		1940	
				Pul.	Non. Pul.	Pul.	Non. Pul.	Pul.	Non. Pul.	Pul.	Non. Pul.
NORTHERN SUDAN											
Admissions for Tuberculosis				418	331	550	336	563	333	480	410
Total Admissions				66,881		67,622		66,961		68,925	
Percentage Tuberculosis to total admissions				0.62	0.49	0.81	0.49	0.84	0.49	0.69	0.59
				1.11		1.30		1.33		1.28	
SOUTHERN SUDAN											
Admissions for Tuberculosis				70	64	73	68	122	63	99	47
Total Admissions				34,207		36,744		38,142		35,497	
Percentage Tuberculosis to total admissions				0.20	0.19	0.20	0.18	0.32	0.16	0.28	0.13
				0.39		0.38		0.48		0.41	

The following table shows the admissions for pulmonary and non-pulmonary tuberculosis in the last ten years and the percentage rate of tuberculosis to other admissions :—

YEAR.				Pulmonary		Non-Pulmonary		Total	
				Admissions	Percentage	Admissions	Percentage	Admissions	Percentage
1931	....	....		390	0.65	294	0.49	684	1.14
1932	....	....		421	0.70	281	0.47	702	1.17
1933	....	....		521	0.74	394	0.56	915	1.30
1934	....	....		557	0.65	437	0.50	994	1.15
1935	....	....		501	0.56	371	0.42	872	0.98
1936	....	....		519	0.54	349	0.36	868	0.90
1937	....	....		488	0.48	395	0.39	883	0.87
1938	....	....		623	0.59	404	0.39	1,027	0.98
1939	....	....		685	0.64	396	0.38	1,081	1.02
1940	....	....		579	0.55	457	0.44	1,036	0.99

AGE INCIDENCE.

The following table shows the incidence of cases and deaths by age from pulmonary tuberculosis :—

AGE PERIODS.	0-1		1-5		5-15		15-25		25-35		35-45		45-65		65 and over		Un-known		Total	
	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
Northern Sudan	—	—	3	2	9	—	110	14	145	25	119	24	64	15	11	4	19	—	480	84
Southern Sudan	—	—	—	—	1	—	23	3	33	4	11	1	2	—	—	—	29	1	99	9

OCCUPATIONAL INCIDENCE.

Comparative table showing the occupations of persons affected with pulmonary tuberculosis in the Northern Sudan during the last 6 years :—

	Cultivators.	Nomads.	Soldiers, Sailors and Police.	Day Labourers.	Townsmen			Indigent and un-employed.	Women not employed	Children.	TOTAL.
					Artisans & Shop-Keepers.	Clerical.	Servants.				
1935 ....	113	15	9	43	94	—	—	51	87	3	415
1936 ....	104	8	14	53	99	—	—	73	96	4	451
1937 ....	117	5	19	73	47	26	12	72	107	10	488
1938 ....	135	—	17	97	61	19	18	86	115	2	550
1939 ....	164	—	13	72	46	11	28	111	108	10	563
1940 ....	132	—	15	62	25	14	15	107	100	10	480

NON-PULMONARY TUBERCULOSIS.

Admissions for non-pulmonary tuberculosis were classified as follows :—

	Gland.	Bone	Joint	Other	Unknown	TOTAL
Northern Sudan ....	101	110	37	63	99	410
Southern Sudan ....	23	13	8	3	—	47

Age groups were as follows :—

	0-1	1-5	5-15	15-25	25-35	35-45	45-65	65 & over	Unknown
Northern Sudan ....	1	13	34	42	109	59	46	7	99
Southern Sudan ....	—	3	10	5	18	6	5	—	—

TUMOURS.

545 cases were admitted, classified as follows :—

Malignant ....	{	Carcinoma ....	....	....	138	
		Sarcoma ....	....	....	38	
		Unclassified ....	....	....	44	.... 220
Benign ....		....	....	....	....	.... 325
						545



The following are the comparative figures for the northern and southern, Sudan, shown as a percentage of total admissions, for the last four years :—

				1937		1938		1939		1940	
				Malig- nant.	Non- Malig- nant.	Malig- nant.	Non- Malig- nant.	Malig- nant.	Non- Malig- nant.	Malig- nant.	Non- Malig- nant.
NORTHERN SUDAN.											
Admissions for new growths	....			161	407	166	321	219	411	205	259
Total Admissions	....	....		66,881		67,662		66,961		63,925	
% of Total Admissions	....	....		0.24	0.60	0.24	0.47	0.33	0.61	0.29	0.37
SOUTHERN SUDAN.											
Admissions for new growths	....			16	164	30	124	17	82	15	66
Total Admissions	....	....		34,207		36,744		38,142		35,497	
% of Total Admissions	....	....		0.04	0.45	0.08	0.34	0.04	0.21	0.04	0.18

UNDULANT FEVER.

43 cases with 2 deaths were reported in 1940. The incidence during the last 10 years has been as follows :—

Year.					Cases.	Year					Cases.
1931	...	...	...	...	25	1936	...	...	...	...	58
1932	...	...	...	...	26	1937	...	...	...	...	33
1933	...	...	...	...	25	1938	...	...	...	...	28
1934	...	...	...	...	51	1939	...	...	...	...	29
1935	...	...	...	...	28	1940	...	...	...	...	43

# PUBLIC HEALTH AND HYGIENE.

(BY MR. H. A. CROUCH.)

## INTRODUCTION.

The rains were scanty and well spaced. Harvests were moderate but, with the exception of a few areas, food supplies were adequate and there was no serious lack of essential commodities.

Economic conditions were satisfactory, there was little unemployment and most classes of the community benefited to some extent from the presence of military reinforcements in the country.

Exhaustive enquiries were made into local food resources and analyses were carried out of a large number of food stuffs with a view to their substitution for imported commodities. Fresh vegetables and fruit were grown on an extensive scale to meet military requirements.

The general health of the population remained satisfactory. The outbreak of yellow fever in the Nuba Mountains was the only serious epidemic. Small outbreaks of smallpox, introduced from abroad, occurred in the Red Sea Area, Northern and Darfur Provinces but no difficulty was experienced in bringing these quickly under control. Cerebrospinal meningitis remained prevalent in the western part of Equatoria and spread to the Upper Nile Province during the dry season. Elsewhere the disease was sporadic. Cases of relapsing fever continued to occur in Kassala, Gezira, Kordofan and Darfur Provinces but nowhere assumed epidemic proportions. Measles, which in 1939 took such a heavy toll of children in many parts of Equatoria, occurred again this year in a few areas of the province but in a much milder form.

There has been little change in the incidence of endemic disease. As a result of favourable climatic conditions, for the second year in succession the incidence of malaria has been much below average.

In spite of the increased activities and demands on staff, public health work of the country has not suffered and it has been possible to maintain steady progress in general sanitary improvement and anti-malarial work. Conservancy work has had to be greatly increased in areas occupied by the Forces. Provision of pit and bucket latrines has been extended in most provinces. Efforts have been directed to raising the standard of cleanliness in villages in the proximity of the larger towns.

Anti-mosquito measures have been augmented in all areas particularly in the neighbourhood of railway premises and aerodromes. More attention has been paid to clearing of harbourage around inhabited areas and to the spraying of premises. Where conditions allow, Paris green has replaced oil as a larvicide on an increasing scale.

No new piped water supplies were installed during the year, but the Khartoum supply was extended to Burri Village and there was a considerable increase in applications for connection to water mains in the Three Towns. A large number of wells in the Eastern Sudan were surveyed for military requirements and analyses carried out for purity and salinity.



## STAFF.

Greatly increased demands were made on the public health staff during the year. Military establishments, epidemics, and labour concentrations in certain areas, taxed resources to the full both in personnel and equipment.

The establishment of British Public Health Inspectors was reduced from 13 to 12. Two Sudanese Public Health Officers, who passed the examination of the Royal Sanitary Institute in December, 1939, were posted during the year making 15 in this cadre since its institution in 1934. Two candidates sat for the 1940 examination, one of whom was successful.

The training of subordinate staff continued without interruption and during the year 11 Sanitary Overseers qualified in Khartoum, 3 in Juba.

## AEDES AEGYPTI SURVEY.

The Yellow Fever epidemic in the Nuba Mountains called for wide and intensive measures in the search and control of the vector, both within the infected area and on all lines of communications. In the Nuba Mountains, extra staff was employed and houses and villages dealt with systematically. Native habitations within 10 miles of El Obeid were surveyed and routine inspections organised. Mosquito men were appointed to railway stations on the section El Obeid to Kosti. Frequent inspections were made of all station premises and of adjacent villages. All east-bound passenger and goods trains were sprayed before departure and again at the Province boundary.

Similar measures were carried out in all areas where previous surveys had shown *Aedes aegypti* to be present. Aerodromes on the southern and western routes were paid particular attention.

Experience in the Nuba Mountains has shown that control of *Aedes aegypti*, in towns by public health staff alone will not be effective in the reduction and final elimination of the vector or remove the menace of an outbreak of Yellow Fever. The people must be made mosquito conscious and carry out, themselves, the necessary measures of control.

In the affected areas the scarcity of water during the dry season and the difficulty of transport contributes largely to the high incidence of *Aedes*, as the people tend to hoard their water supplies and neglect to empty or clean the containers. In such circumstances *Aedes* probably breeds in houses all the year round and the farther a house is from water, the more likely is it to be infested with *Aedes*.

Breeding in tree holes and rocky pools further complicates the problem. In the Juba area no less than 40% of the total *Aedes* findings were discovered in breeding places of this nature. Of 1,100 Heglig trees examined recently more than half that number had one or more holes filled with cement.

The problem calls for a combined effort on the part of Medical, Administrative and Native authorities. Plans are in hand for the launching of intensive propaganda campaigns in schools, hospitals, dispensaries and tribal gatherings.

Recent experience has shown that the existing organisation for the detection and control of *Aedes aegypti* is unsatisfactory—and that the findings hitherto published give an incomplete picture of the true situation. The system of inspection and identification is to be reorganised and the work supervised by specially trained *aedes* Control Units under the direction of the Medical Entomologist.

## SANITARY CONTROL OF AIRCRAFT.

The work of inspection and disinsectisation of aircraft was carried out very thoroughly this year in order to reduce to a minimum the risk of transport of infected mosquitoes to territories abroad.

The following inspections were made :—

Khartoum	....	....	....	....	663	Juba	....	....	....	....	64
Malakal	....	....	....	....	63	Geneina....	....	....	....	....	218

Nine adult mosquitoes were found in aircraft arriving at Khartoum ; 3 were from Egypt, 4 from Italian East Africa and 2 from West Africa. All were species of *Culex* with the exception of one *Anopheles* from West Africa and one specimen of *Aedes capsians* from Cairo.

No adult mosquitoes were found in aircraft arriving at Malakal and no *Aedes aegypti* infections were reported in the town.

At Juba one adult *Culex* was found on a northbound machine on arrival. Inspection of aircraft which had been standing on the aerodrome overnight revealed the presence of mosquitoes on six occasions—in each case these were *Culex*.

Five anopheline infections were found on aircraft arriving at Geneina.



# THE HEALTH AND SANITATION OF PROVINCES.

## KHARTOUM PROVINCE.

Area — 5,700 sq. miles. Population — 252,676.

### GENERAL.

Rains were light and the river low. There was little malaria in the Three Towns but a considerable number of cases occurred in the Rural District. Typhoid Fever showed some increase in Omdurman during the autumn months and rabies was still active on the west bank of the river at the end of the year.

### VITAL STATISTICS.

#### POPULATION.

The total population of the Province showed an increase of some 3,500. This was due for the most part to an increase in the native communities and to the fact that owing to the war situation more Europeans remained in the country.

#### BIRTHS AND DEATHS.

The registered births were 4,690, deaths 2,329—an excess of births over deaths of 2,301.

Though 1940 was a healthy year and marked by an absence of epidemics with high mortality, the death rate in all districts was higher than that of 1939, though lower than 1938, a year of heavy rainfall and high river.

The death rate remained fairly constant throughout the year without any notable monthly variation.

The increase was most marked in the 0-1 and 1-5 age groups. Diarrhoea and dysentery was the principal cause, accounting for 38.2 per cent. in the former and 60.7 per cent. in the latter group. Corresponding figures for last year were 21 per cent. and 47 per cent.

### COMMUNICABLE DISEASES.

#### MALARIA.

The incidence of malaria was approximately the same as last year. This disease continues to be the principal cause of sickness in the Rural District. Most of the villages are sited on the river bank and the inhabitants are therefore subject to infection as the river falls. Removal of villages further from the bank would be an expensive and formidable proposition but would undoubtedly benefit the health of the people.

#### DYSENTERY.

Though the rainfall was slight this year, the period of high humidity was prolonged. Such conditions favour fly breeding and are the probable cause of the rise in dysentery cases.

### **ENTERIC FEVER.**

The increased incidence of enteric fever may be accounted for in the same way. There were 278 locally contracted cases as compared with 86 last year. Mass inoculation was carried out chiefly amongst school children who had provided most of the cases. The mortality rate was 4.9% as compared with 13 per cent in 1939.

Promiscuous defaecation in cultivation areas is probably the principal source of infection of both enteric fever and dysentery. The programme of construction of public and private latrines continues but much remains to be done.

### **TUBERCULOSIS.**

The incidence of tuberculosis appears to be on the increase. 427 cases came to the notice of the Public Health Authorities and of these 148 cases were notified. This is a high figure for a native population in a country where bovine tuberculosis is practically unknown. To some extent the figure is an index of overcrowding and lack of nutrition. Improvement lies in better housing and a general raising of the standard of living.

### **DIPHTHERIA.**

There were 44 cases and 6 deaths. 23 of these occurred in the age group 1-5, 11 between 5 and 10 years.

### **RELAPSING FEVER.**

There were 27 cases of relapsing fever, all imported from the adjacent Gezira Province where the disease is endemic. A constant watch was maintained as an outbreak was liable to occur at any time.

Delousing of native communities was carried out on a large scale.

### **BILHARZIA.**

Of 129 cases notified, 5 were locally contracted in Omdurman, 106 in the Rural District.

### **THE CENTRAL PRISON, KHARTOUM NORTH.**

The average daily strength of prisoners was 403.

The reformatory held a varying number of juveniles for whom special work and instruction were provided.

Admissions to hospital numbered 142. An outbreak of a mild type of influenza occurred but only one patient required hospital treatment. No case of tuberculosis was notified.

Patients of unsound mind kept in good bodily health and were given a fair measure of liberty—several being employed in the prisons workshops.

### **SCHOOL MEDICAL INSPECTION.**

A total of 5,141 boys and girls were examined during this year as compared with 6,646 in 1939. Epidemic and A.R.P. duties took up much of the time of the Assistant Medical Officer of Health and the programme of inspections had to be curtailed.

Apart from a mild outbreak of chickenpox, the health of school children was good. The principal conditions found at inspection were trachoma, and dental and visual defects.



Trachoma showed a slight decrease on previous years but still heads the list of diseases. Dental defects are most prevalent in Elementary Schools. Carious teeth associated with root abscess are the commonest manifestations. In about 30% of cases the child is found to be in a poor state of health. Among the older boys of the Intermediate Schools and Colleges, pyorrhoea is not so common but pits and cavities of the permanent teeth are frequently seen.

The number of cases of enlarged spleen was found to be 3 per cent. in schools in the Municipality, 7 per cent. in the Rural District.

### NORTHERN PROVINCE.

Area — 236,200 sq. miles. Population — 535,176.

A poor Nile flood resulted in scanty grazing for animals but crops were fair and there was no food shortage.

A small outbreak of smallpox occurred in the Shereik district in August. There were 44 cases with 13 deaths. 30,000 inhabitants of the surrounding districts were vaccinated and the outbreak was speedily brought to a close. No case of cerebro-spinal meningitis was reported.

There was some increase in the incidence of Enteric Fever due largely to the immigration of numbers of families from areas affected by war conditions. An outbreak of Influenza occurred in the southern part of the Province in March and continued until May. There were no deaths.

Unlike most other areas there was an increase in the incidence of Malaria. In this Province the incidence is little influenced by rainfall and the majority of infections occur as a result of mosquito breeding in pools left by the falling river.

In approximately 8,000 examinations, carried out for the presence of Schistosomiasis, 6.25% were found to be infected.

Despite large concentrations of civil and military populations in the larger towns, the incidence of Dysentery remained low. A total of 90 cases was treated, of which 72 were amoebic and 18 bacillary.

The increased population of Atbara and the larger towns necessitated a considerable increase in public health staff and equipment. Services were well maintained and in some instances extended. Additional ante-natal and child welfare clinics were established with satisfactory results.

Mosquito surveys failed to reveal the presence of *Aedes aegypti*.

### GEZIRA PROVINCE.

Area—54,605 sq. miles. Population—968,548.

The general health of the Province was better than in most years. The chief factor contributing to this improvement was the large reduction in the number of cases of Malaria. Incidence during all months of the year was consistently lower than at any period during the past four years and about half that of 1939. This reduction is in large measure due to the decreased rainfall but in addition to anti-malarial measures which were intensified in order to achieve as high a standard of health as possible during war time. Methods of control were similar to those adopted in previous years. In the irrigated area baling has been very thorough and undoubtedly has assisted greatly in reducing the incidence of Malaria. In the White Nile District marked improvement was noted in anti-malarial measures in private pump schemes.



The predominant vector in the Gezira and White Nile Areas is *Anopheles gambiae*. Investigations into the bionomics of this mosquito continues. Malignant tertian is the prevailing infection.

An epidemic of Relapsing Fever occurred in the Gezira during February, March and April and from September until the end of the year. 670 cases were seen with 19 deaths. Relapsing Fever is now endemic in this area and outbreaks are liable to occur during the cold weather. 12,200 persons were deloused. An interesting development in connection with these outbreaks is the institution of village treatment and control. Cases are treated on the spot in temporary hospitals and the whole village population is deloused at the same time. This arrangement has proved efficient and had led to considerable economy in transport and hospital accommodation.

As a result of widespread vaccination carried out in the Province during the past few years only 14 cases of smallpox occurred during 1940.

Owing to depletion of staff caused by withdrawals for war service, the annual bilharzia survey was not done. Routine examinations were carried out in dispensaries and it is satisfactory to note that the percentage figures of infections obtained at these examinations closely resemble the results obtained for annual surveys. These surveys have been carried out by different observers since 1931 and the results show that there is no appreciable increase in bilharzia in the irrigated area.

The average percentage infected for adults and children since 1931 is 0.22 and 0.72 respectively.

The work of hospitals shows a decrease in comparison with the figures for 1939. Inpatients are less by 17%, outpatients by 1.2%. The decrease is accounted for by the great reduction in the incidence of malaria and to abnormal conditions arising out of the war. The activities of certain dispensaries in the Fung District were curtailed by operations near the Eastern Border.

### KASSALA PROVINCE.

Area—134,450 sq. miles. Population—421,978

The work of hospitals and dispensaries in this Province was disorganised temporarily owing to the eastern Sudan becoming a theatre of war, but public health work was stimulated by the presence of troops and anti-malarial measures and general sanitation were maintained at a high standard of efficiency.

With the exception of an outbreak of smallpox in the Red Sea district there were no epidemics, though sporadic cases of relapsing fever occurred in the Gedaref area.

Restriction of movement by civilians across the border and within the Province was probably instrumental in the limitation of the spread of infectious disease.

### PORT SUDAN. Population 26,255.

Apart from the usual high incidence of amoebic dysentery amongst the native population and a number of cases of bacillary dysentery amongst the troops, the health of Port Sudan remained satisfactory.

An outbreak of smallpox in the district caused some anxiety but a vigorous vaccination campaign and strict quarantine measures quickly brought the situation under control. Cases were first detected at Suakin quarantine amongst pilgrims returning from the Hedjaz; later cases occurred at Tokar and in the foothills of the coastal plain between Tokar and Suakin and finally in Port Sudan itself. The source of the Tokar outbreak was not definitely established, but cases were said to have been in contact with returning pilgrims, though before cases had occurred



in the quarantine. Port Sudan was directly infected from Tokar. A total of 174 cases and 60 deaths occurred in the three outbreaks. 74,833 vaccinations were carried out and quarantine restrictions vigorously enforced. No passengers were allowed to leave Port Sudan by train or car unless in possession of a vaccination certificate and similar measures were taken to prevent spread of infection between Tokar and Suakin and between these towns and the Red Sea Hills.

The incidence of dysentery amongst the native population remains high. 991 cases of amoebic and 24 cases of bacillary dysentery were reported. Infection is maintained and spread by the continued prevalence of flies especially during and after the rains. The humid warm atmosphere of the coastal belt is very favourable to breeding and a high standard of sanitation is required if permanent improvement is to be realized. The first requirement is adequate sanitation in native lodging areas. Plans for the installation of public and private latrines were under consideration at the outbreak of war but have had to be postponed. Meanwhile weekly house-to-house inspections have led to considerable improvement in the general cleanliness of compounds and in the disposal of refuse.

#### Anti-mosquito work.

In the same way house-to-house inspections have led to a further drop in *Aedes aegypti* infestations.

This improvement is largely due to the cooperation of house holders who are now beginning to learn the importance of the weekly emptying and drying out of water containers.

#### Rat Control.

Rat catchers and traps have been further increased and 706 more rats were caught than in the previous year. The number of fleas per rat is also decreasing.

Further improvements have been made in the rat proofing of warehouses and sheds on the quays and of private premises.

Rat guards are compulsory for all ships moored against the quays.

The total numbers of rats caught during the past 5 year are as follows :—

1936	1937	1938	1939	1940
5,302	8,499	12,215	16,518	17,224

#### Rat Fleas.

The flea census per month together with the prevailing atmospheric conditions was as follows :—

MONTH.	Fleas per rat.	Average Temperature Shade		Average Relative Humidity.
		Maximum °C.	Minimum °C.	
January	0.8%	27.8	19.6	70
February	0.8%	29.4	19.4	65
March	0.8%	28.6	18.2	61
April	0.8%	31.0	23.0	62
May	0.8%	35.7	24.4	54
June	0.8%	40.4	26.1	49
July	0.8%	41.2	29.4	46
August	0.8%	39.3	28.5	51
September	0.9%	38.6	26.2	44
October	1.0%	34.3	26.3	66
November	0.8%	29.8	23.1	61
December	0.9%	29.0	22.2	70



## KORDOFAN PROVINCE.

Area—147,100 sq. miles. Population—1,251,295.

Except for the epidemic of Yellow Fever in the Nuba Mountains the public health of the province was satisfactory throughout the year.

Rainfall was considerably below normal in all districts. There was a good average harvest except in the northern part of the province.

Although no appreciable extension of services was possible an increase in medical work is recorded. Considerable interference in normal routine work was caused by the exigencies of war and the Yellow Fever epidemic. Fortunately no other serious outbreak of infectious disease occurred. There were sporadic cases of cerebrospinal meningitis and diphtheria and minor outbreaks of influenza. No case of smallpox was reported, but the vaccination campaign in progress last year was continued until April. Vaccinations numbered 78,576. Seven cases of relapsing fever occurred with no deaths as compared with 13 cases and 7 deaths in 1939. The delousing stations at El Obeid and Nahud were closed down early in the year.

The incidence of malaria was less than last year, partly due to the light rains. 4575 cases of urinary bilharziasis were treated at hospitals and dispensaries as compared with 3412 in 1939. The increase is largely due to recruiting for the army which has brought forward for treatment large numbers who, otherwise, would not have been seen.

Dracontiasis is endemic in the Nuba Mountains. The total cases seen at hospitals and dispensaries numbered 615 compared with 470 in 1939. Of the total, 538 were reported from the Nuba Area.

The incidence of dysentery was higher than last year. The total of all dysenteries treated at hospitals was 3051 compared with 2702 in 1939.

Leshmaniasis was reported from this province for the first time. Nine cases of oriental sore were diagnosed at Kadugli hospital—all contracted the disease in the area. Two imported cases were treated at El Obeid hospital.

Rabies is widespread throughout the province and three people developed the disease, one of whom had received two injections, the remainder none. Cases receiving prophylactic treatment for exposure to rabies infection numbered 251 compared with 202 in 1939.

There was an increase in the number of cases of venereal disease treated. Gonorrhoea is mainly a disease of the towns, and rural areas hitherto have been relatively free. This year cases have been more widespread and the increased incidence is partly attributable to war conditions.

There were no important developments in public health work during the year. Improvement in general sanitation has been maintained despite economies necessitated by the war. The rains were light and well spaced and as a result anti-malarial activities were on a reduced scale. Measures were, however, extended in the smaller towns. The yellow fever epidemic necessitated special attention to anti-aedes work. Routine inspections were carried out in all villages within 10 miles of El Obeid and at all railways stations. Medical staff in charge of dispensaries arranged house-to-house inspections in adjacent villages, sprayed dwellings, and carried out an intensive propaganda among the people.

The health of prisoners on the whole was satisfactory. Minor outbreaks of chickenpox and influenza occurred in various prisons.

Routine examination of children revealed the fact that except for a decrease in the splenic index, there was little change in the percentage suffering from chronic malaria, bilharzia and trachoma.



## DARFUR PROVINCE.

Area — 138,150 sq. miles. Population — 715,543.

The general health of the Province compared favourably with that of previous years. Localised outbreaks of smallpox occurred in scattered districts. 255 cases with 55 deaths were reported, mainly in the Dar Masalit area. Vaccination on a large scale was carried out in 1939 and a further 61,000 were completed this year.

Relapsing fever is endemic in the Province and a further 114 cases were reported with 9 deaths. These occurred mostly in the central and western areas. The disease is now well known to the people and they understand and readily submit to the measures taken for their protection. A small epidemic of influenza occurred in Fasher with 61 cases and one death. There were other minor outbreaks throughout the province, but the disease was mild and few deaths were reported.

Unlike most provinces, malaria was as prevalent as usual and nearly 5,000 cases were diagnosed clinically during the year.

Vesical bilharziasis is widespread and is frequently found at examination of recruits for the Sudan Defence Force.

Apart from injuries, syphilis is the commonest cause of attendance at dispensaries.

Little change has been made in the public health work of the Province. There is steady progress in the services of the larger towns and a beginning has been made in the improvement of village sanitation. Special attention has been paid this year to the control of *Aedes* mosquitoes. El Fasher and district is heavily infected and the reduction and final elimination of the mosquitoes is a matter of first importance. Staff has been increased and a survey has been made of the whole district. A prolific source of breeding are huts inhabited by old and indigent folk, too feeble in mind and body to carry out the required precautionary measures. It is intended to concentrate these people in one area to simplify the control of mosquito breeding. Since additional measures have been taken the number of *Aedes* infestations has fallen considerably but much remains to be done before elimination is accomplished.

## UPPER NILE PROVINCE.

Area — 92,270 sq. miles. Population — 520,700.

There has been no change of note in the general health of the Province during the year.

Epidemic pneumonia which started in the last three months of 1939 in the Zeraf District continued to the end of April, 1940 when it died out. Many deaths were reported. The District Commissioner, Western Nuer, reports that there were 4,000 fewer taxpayers in the 1940 listing than in 1939. He attributes this largely to the pneumonia epidemic. A small outbreak of cerebrospinal meningitis occurred in the Shilluk country and in adjacent Dinka villages. Cases numbered 474. The mortality rate was approximately 44% in spite of the fact that many cases received no treatment. Influenza was widespread and mild in type. Few deaths were reported where treatment was available.

Incidence of malaria was low this year on account of the light rainfall. 291 cases were admitted to hospital as compared with 528, last year.



The fall in the number of cases of enteric fever noted in last year's report has not been maintained. 17 cases occurred with 2 deaths in hospital as compared with 4 cases and 1 death last year. Enteric fever has been endemic in Malakal for a number of years and in 1938 there was a sharp outbreak of 46 cases. An investigation was carried out for the detection of carriers. Many of the convalescent cases of typhoid for the last 2 years were traced and of these, three were found to be carrying bacilli. It is apparent that the frequent and prolonged observation of convalescents is an important measure in the control of the disease.

Progress has been made in the cleaning up of Malakal but extensions to the conservancy system had to be postponed owing to exigencies arising out of the war. Following the outbreak of Yellow Fever in the Nuba Mountains stringent anti-mosquito measures were taken and a thorough inspection was made of Malakal and the surrounding district. No *Aedes aegypti* infections were found.

### EQUATORIA PROVINCE.

Area — 159,750 sq. miles. Population — 1,192,401.

The rains were generally poor and ill-spaced although the Kapoeta District received an unusually heavy rainfall.

Harvests were not good but should suffice the needs of the people generally.

Cerebrospinal meningitis occurred during the first three months of the year in the Wau area and continued among the Dinka population throughout the year. Altogether some 3,000 cases were seen and treated. The mortality rate was 20%. Deaths include untreated cases and those found moribund.

There were 31 cases of smallpox in the Rumbek area with 3 deaths. A fair proportion of the people in the Province have now been successfully vaccinated.

Chickenpox broke out in the Juba District, but less than 100 cases were reported. Measles appeared around Rumbek, where some 260 cases were seen with a mortality of 10%.

The disease was mild and unattended by the disastrous sequelae of last year's epidemic, when thousands of children were carried off by intractable gastro-enteritis and broncho-pneumonia.

There was no other outbreak of epidemic disease of significance.

Malaria showed increased incidence among the British, European and Northern officials. Although it is a disease of which the local native rarely complains, yet the high splenic index shows its prevalence amongst children and associated with infantile diarrhoea, it is without doubt one of the chief causes of the high infantile mortality.

Rectal schistosomiasis appears to be only too common in the part of the Province lying to the west of the Nile, yet the disease does not seem to have penetrated into the Torit and Kapoeta Districts. Until it is possible to organise mass treatment and to improve the water supplies and habits of the people, any appreciable lowering of the incidence of this debilitating disease cannot be effected.

Leishmaniasis is at present limited to the Kapoeta area. 36 cases were treated in hospital as compared with 72 last year. It is unlikely that these figures indicate a fall in the incidence of the disease.

With the exception of the Torit and Kapoeta Districts, the Province is heavily infested with ancylostomiasis. The experiment of providing shoes in two different districts did not produce conclusive results.



There has been some slight decrease in the prevalence of dracontiasis. Owing to the time it takes for the worm to develop in its human host, a lower incidence, following on the provision of anti-guinea worm wells, must take some time to develop.

The position regarding sleeping sickness during 1940 may be regarded as satisfactory and some measure of "decontrol" was possible which should improve the well being of the people. Progress in fly eradication has been sufficiently encouraging to warrant extension of this method of control.

Although some parts of the Province are happily fairly free of venereal disease, others, particularly Wau and the Zande districts are heavily infected. One group of Zande labourers on examination showed that about one in five was suffering from some new and acute form of venereal disease. Gonorrhoea may not kill the individual but it may go far to kill the race by sterilizing the people.

Sanitation in the principal towns continues to improve and the standard attained is generally fair. Steady progress is being made in the provision of pit and bucket latrines throughout the Province. Experiments were carried out with a view to providing a substitute for Ialine disinfectant for use in conservancy buckets. Cotton seed tar was found to be a satisfactory deodorant and has been in use since August. It is estimated that the use of this tar will result in a saving of some 250 gallons of Ialine per annum in Juba alone.

Fly breeding continues to be a source of considerable trouble. In the course of the year larvae were found in a number of interesting breeding places including potatoes, onions, mangoes and in the rotting trunks of paw-paw and banana trees.

Mosquito control is rapidly extending in and around towns. In Juba there was a slight drop in the number of mosquito infections found though the proportion of anopheles was higher than last year. *Aedes* infections were slightly fewer than in 1939, but still remain high in spite of wider and more frequent inspections. Control is a difficult problem as breeding is by no means limited to domestic surroundings. This year over 40% of infections found, were in rock pools and tree holes.

The protection, and in some places, the provision of good water supplies provides one of the most urgent problems. The heavy incidence of the disabling water-borne diseases is only too well known. Anti-guinea worm tops have been fitted to many wells and it is hoped to undertake an extended programme of progressive improvement of water supplies throughout the Province.

Nutrition which is a matter of such fundamental importance to this Province is now in the hands of a special committee. The first work which is necessarily the collection of statistics and data is proceeding.

## MATERNITY AND CHILD WELFARE.

24 pupil midwives were under training at the Midwifery School during the year and though the course had to be curtailed, all conducted 20 deliveries and completed the course of lecturers. 32 midwives attended a revision course during the second half of the year. It is satisfactory to record that training was thus continued despite difficult circumstances and the fact that the School for a period was maintained as a first aid station. 362 midwives have been trained since the School opened of whom 290 are still practising. The distribution of midwives in the provinces is as follows:—

Khartoum Province	....	....	70	Kassala Province	....	....	....	26
Gezira	„	....	57	Darfur	„	....	....	10
Kordofan	„	....	40	Upper Nile	„	....	....	4
Northern	„	....	83					



MATERNAL MORTALITY.

It is only in the towns where the population is entirely served by trained midwives that it is possible to obtain reliable information regarding maternal mortality and the complications of child birth.

The midwives of Omdurman attended 2015 (1984) cases, 20 (13) being classed as abnormal. 46 (25) patients were transferred to hospital where one died. 43 (67) cases of abortion were treated by the midwives, 3 being septic and transferred to hospital. A further 175 cases were delivered in Omdurman hospital of which 160 were classed as abnormal.

The number of registered live births in Omdurman was 2000 (1959). The number of maternal deaths 16.

Total Maternal Mortality Rate (Omdurman) ...	...	...	...	...	9.9 (3.6)
Puerperal Sepsis ...	...	...	...	...	— —
(only 2 deaths were attributed to puerperal sepsis)					
Infantile Mortality Rate (Omdurman) ...	...	...	...	...	90.8 (81).

The following statistics are compiled from the records of cases treated in the hospitals of Khartoum, Khartoum North and Omdurman.

The figures in brackets are those recorded for 1939.

Total number of live births registered in the Three Towns 3617 (3511).

Total cases attended in hospital:—

(a) Normal ....	44 (78)	(c) Recovered ....	350 (262)
(b) Abnormal ....	322 (198)	(d) Died ....	16 (14)
(e) Live Births in hospital ....		146 (121)	

Complications and Causes of Death.

						Total.	Recovered.	Died.
Abortions ....	Septic ....	7 (3)						
	Others ....	80 (82)	87 (85)	84 (85)	3 (0)			
Puerperal sepsis ....	Normal labour ....	25 (13)						
	Abnormal labour ....	20 (7)	45 (20)	41 (18)	4 (2)			
Puerperal haemorrhage	Placenta praevia ....	4 (4)						
	Other causes ....	22 (7)	26 (11)	25 (11)	1 (0)			
Puerperal albuminuria and convulsions			9 (12)	8 (11)	1 (1)			
Other toxæmias of pregnancy			9 (1)	9 (1)	0 (0)			
Phlegmasia alba dolens			4 (1)	3 (1)	1 (0)			
Embolism								
Other accidents and abnormal condition of the puerperal state			89 (41)	83 (36)	6 (5)			
Illness complicating, but not directly due to pregnancy			71 (49)	67 (42)	4 (7)			
			340 (220)	320 (218)	20 (15)			

MATERNAL AND CHILD WELFARE CLINICS.

58,770 attendances, of which 8,431 were new cases, were recorded at 20 clinics in the towns of the Northern Sudan and 1 in the Southern Sudan.

9,025 attendances, with 3,515 new cases were reported from the clinics in Khartoum, Khartoum North and Omdurman. The infant mortality rate for these Three Towns was as follows:—

Khartoum ...	72.0	per 1000 live births.
Khartoum North	54.7	„ „ „ „
Omdurman	90.8	„ „ „ „

78.5% of the cases delivered at the Midwifery School had attended the ante-natal clinic.

In the Northern Province additional clinics were established in Atbara and Merowe and were well attended.



## SCHOOL MEDICAL SERVICE.

Calls on staff for epidemic, A.R.P. and other emergency duties did not allow of any expansion of school medical work during the past year. 42,572 pupils were examined in 504 schools as compared with 43,505 in 586 schools in 1939.

In the northern and central Sudan trachoma still heads the list of defects. The disease is commonest in villages and elementary schools but tends to become quiescent as pupils advance in age. This may be accounted for by continued treatment, cleaner habits and improved living conditions.

Following on two good malarial years a decrease in the splenic index rate was recorded in some areas. Little change was noted in the percentage suffering from Bilharzia.

Steady progress has been made in the improvement of school buildings. Primary consideration has been given to the provision of concrete floors in elementary schools of the northern Sudan and further attention paid to relief of overcrowding, better ventilation and the provision of latrines.

In southern schools, rules have been laid down fixing accommodation required for pupils in school dormitories and classrooms. Lighting, ventilation and the size and type of desks required are also specified. Advice on latrine accommodation, simple mosquito control measures, refuse disposal and the protection of water supplies is circulated.

There has been no serious outbreak of epidemic disease and the general standard of health and physique of pupils may be regarded as satisfactory. Only one case of tuberculosis was discovered among the 42,572 pupils examined.

The following table shows the result of the examinations :—

PROVINCE AND DISTRICT.	No. Exam.	% Tracho- ma	% Bilhar- zia	% Spleen	% Pulm. T.B.	% Ancy- lost.
<b>Darfur Province :—</b>						
Fasher District ... ..	504	43.4	47.02	24.2	—	—
Geneina District ... ..	63	92.06	17.4	69.8	—	—
Nyala District ... ..	277	6.1	38.6	5.9	—	—
<b>Equatoria Province :—</b>						
<b>JUBA DISTRICT.</b>						
11 Elementary ... ..	661	4.08	5.9	13.9	.15	14.2
<b>WAU DISTRICT.</b>						
7 Elementary ... ..	597	1.3	3.3	27.4	—	7.3
<b>ZANDE DISTRICT.</b>						
6 Mission Schools ... ..	478	—	26.9	29.4	—	19.6
<b>Gezira Province :—</b>						
<b>GEZIRA AREA.</b>						
2 Intermediate ... ..	263	11.0	0.7	19.7	—	—
13 Elementary ... ..	3,057	19.7	0.3	10.8	—	—
120 Village ... ..	6,564	12.8	0.3	13.9	—	—
<b>WHITE NILE AREA.</b>						
1 Teachers Training School ...	121	23.9	9.1	07.4	—	—
1 Intermediate ... ..	101	28.7	19.8	24.7	—	—
2 Girls ... ..	126	40.4	11.1	15.0	—	—
4 Elementary ... ..	584	31.5	3.8	18.3	—	—
1 Village ... ..	46	28.2	2.1	17.3	—	—
<b>FUNG AREA.</b>						
8 Elementary ... ..	1,140	29.4	4.1	33.8	—	—
4 Girls ... ..	385	27.2	—	17.6	—	—
8 Village ... ..	472	6.7	—	49.1	—	—

PROVINCE AND DISTRICT.	No. Exam.	% Tracho- ma	% Bilhar- zia	% Spleen	% Pulm. T.B.	% Ancy- lost.
<b>Kassala :—</b>						
KASSALA DISTRICT.						
4 Elementary ... ..	292	18.8	—	38.6	—	—
4 Village ... ..	297	31.6	—	55.5	—	—
PORT SUDAN.						
1 Intermediate ... ..	149	23.4	1.3	.67	—	—
1 Elementary ... ..	180	34.4	2.7	1.6	—	—
Coptic School ... ..	171	21.05	0.58	1.1	—	—
Greek School ... ..	30	3.3	—	—	—	—
Egyptian School ... ..	122	31.9	0.9	—	—	—
<b>Khartoum Province :—</b>						
Gordon College ... ..	472	25.2	—	1.4	—	—
National School ... ..	329	20.6	—	1.8	—	—
5 Intermediate ... ..	1,210	26.6	—	1.8	—	—
15 Elementary ... ..	2,837	36.0	0.03	3.9	—	0.3
88 Village ... ..	1,469	65.0	—	4.6	—	—
3 Girls ... ..	600	18.6	—	—	—	—
<b>Kordofan Province :—</b>						
CENTRAL DISTRICT.						
1 Intermediate ... ..	105	7.6	0.9	5.7	—	—
9 Elementary ... ..	1,149	2.001	5.5	17.7	—	—
4 Village ... ..	316	21.5	3.1	29.4	—	—
WESTERN DISTRICT						
5 Elementary ... ..	583	24.3	1.9	31.7	—	—
5 Village ... ..	245	12.2	4.8	49.4	—	—
NUBA AREA.						
6 Elementary ... ..	539	13.3	36.1	55.6	—	—
3 Village ... ..	216	12.5	23.0	59.7	—	—
<b>Northern Province :—</b>						
WADI HALFA DISTRICT.						
1 Intermediate ... ..	158	34.1	11.6	6.3	—	—
6 Elementary ... ..	1,028	54.2	10.9	2.8	—	0.5
15 Village ... ..	1,973	59.4	16.8	2.9	—	0.9
DONGOLA DISTRICT.						
12 Elementary ... ..	1,746	40.8	3.09	14.3	—	1.6
39 Village ... ..	2,459	40.5	2.3	18.1	—	0.3
BERBER DISTRICT						
2 Intermediate ... ..	204	37.2	2.4	4.9	—	—
1 Technical ... ..	91	29.6	1.1	4.3	—	—
17 Elementary ... ..	2,253	38.1	7.1	8.2	—	0.6
52 Village ... ..	2,843	36.1	1.7	12.1	—	0.2
<b>Upper Nile Province :—</b>						
1 Elementary ... ..	67	25.3	—	20.8	—	—



## QUARANTINE.

### PORT SUDAN QUARANTINE.

No ships were quarantined during the year. Two cases of measles, and one each of scarlet fever and diphtheria were removed from ships arriving in the Port.

The system of radio-pratique was discontinued owing to the war.

The harbour for native sailing craft established at Flamingo Bay continues to work satisfactorily and provides organisation for the control of infectious disease and the introduction and breeding of *Aedes aegypti*.

In April, six cases of relapsing fever were discovered among the crew of a dhow arriving from Massawa. Cases and contacts were deloused and quarantined. No secondary cases occurred.

The health of the Port and district was satisfactory. A small outbreak of smallpox occurred in a native lodging area in June. There were 18 case and 7 deaths.

Compulsory vaccination was introduced and the outbreak was quickly brought under control. With the exception of a few cases of enteric fever and diphtheria there was no other outbreak of infectious disease.

### SUAKIN PILGRIM QUARANTINE.

The number of pilgrims showed a decrease.

The figures for outgoing pilgrims for the last ten years are as follows :—

1931	...	...	...	2,414	1935	...	...	...	1,672	1939	...	...	...	5,523
1932	...	...	...	1,348	1936	...	...	...	3,404	1940	...	...	...	3,204
1933	...	...	...	970	1937	...	...	...	6,346					
1934	...	...	...	1,459	1938	...	...	...	8,159					

All pilgrims were vaccinated against smallpox and inoculated against cholera before departure. Pilgrims paid in advance their return steamer fare and the quarantine charges in Arabia Seoudia.

The health of pilgrims was satisfactory except for infectious disease. 14 cases of smallpox occurred with 4 deaths. The quarantine period was extended from 24 hours to 14 days and all pilgrims were vaccinated on arrival. Those that did not "take" successfully were re-vaccinated on departure.

In addition there were 46 cases of chickenpox, 16 cases of measles and one case of cerebrospinal meningitis. In all 159 cases were admitted to hospital with 6 deaths.

1,622 Nigerian and West African pilgrims who had left via Massawa and who, contrary to the obligations of the International Sanitary Convention, had not been given return tickets, became destitute and had to be returned via Suakin.

On June 13th while the last boatload of pilgrims were in quarantine the huts were bombed and machine-gunned by an Italian aircraft. Four pilgrims were injured. The pilgrims in quarantine were promptly released, and as a result a few sporadic cases of smallpox were reported in the Northern Province.

### WADI HALFA QUARANTINE.

1,041 Egyptian labourers passed through the quarantine. 213 were treated for bilharziasis either at Wadi Halfa or their destination.

# OPHTHALMIC REPORT.

BY MR. A. R. McKELVIE.

58 male beds and 30 female beds were provided for Eye Diseases in the River Hospital.

The Eye Dept., was transferred on 6.11.40 from the River Hospital to the New Khartoum Eye Hospital. Only 70 beds are provided in this Dept., of which 46 beds for male and 24 beds for female.

The following figures summarise the work carried out during the year :—

							Khartoum Eye Hospital.	Omdurman Eye Hospital.	TOTAL.
INPATIENTS.									
1938	...	...	...	...	...	...	615	125	740
1939	...	...	...	...	...	...	693	146	839
1940	...	...	...	...	...	...	582	112	694
OUTPATIENTS.									
<i>Total attendances.</i>									
1938	...	...	...	...	...	...	36,781	39,295	76,076
1939	...	...	...	...	...	...	44,230	29,811	74,041
1940	...	...	...	...	...	...	52,918	31,416	84,334
NEW CASES.									
1938	...	...	...	...	...	...	6,019	6,336	12,355
1939	...	...	...	...	...	...	9,391	8,511	17,902
1940	...	...	...	...	...	...	10,341	11,158	21,499
OPERATIONS.									
<i>Major.</i>									
1938	...	...	...	...	...	...	476	84	560
1939	...	...	...	...	...	...	549	125	674
1940	...	...	...	...	...	...	408	90	498
<i>Minor.</i>									
1938	...	...	...	...	...	...	316	9	325
1939	...	...	...	...	...	...	292	10	302
1940	...	...	...	...	...	...	307	15	322



# EYE OPERATIONS

MONTHS			CATARACT		GLAUCOMA					IRIDECTOMY OPTICAL	ENUCLEATION	PTERYGIA	
			Extraction	Needling	Sclerectomy	Trephine	Cyclodialysis	Filtrating Iridectomy	Iridenclesis				Hyphama
January	...	...	12	2	—	2	—	1	—	—	4	—	4
February	...	...	12	7	—	—	2	4	—	—	2	2	7
March	...	...	14	2	1	1	—	3	—	—	5	1	1
April	...	...	15	5	—	3	3	6	—	—	9	—	4
May	...	...	8	3	—	3	2	1	—	—	3	2	5
June	...	...	2	2	—	1	—	1	—	—	2	1	1
July	...	...	5	1	1	2	3	—	—	—	7	2	1
August	...	...	9	—	—	—	—	4	—	—	3	1	7
September	...	...	7	1	—	—	1	1	—	—	3	1	2
October	...	...	—	—	—	—	—	—	—	—	1	2	1
November	...	...	2	—	—	2	1	1	—	—	3	—	1
December	...	...	9	1	—	2	—	3	—	—	4	—	6
TOTAL ...			95	24	2	16	12	25	—	—	46	12	40

# INPATIENTS TREATED IN THE

MONTHS.	EYE LIDS					CONJUNCTIVA						CORNEA				
	Blepharitis.	Chalazion	Trichiasis	Ptosis	Injury	Conjunctivitis	Trachoma	Phryg. Pterygium	Spring Catarrh			Dacryocystitis	Corneal growth	Ulceration	Keratitis	
January ... ..	—	—	3	—	—	12	1	—	—	—	2	—	1	—	7	2
February ... ..	1	—	2	—	—	14	7	—	—	—	—	1	1	1	2	—
March ... ..	—	—	7	—	—	22	13	—	2	—	2	—	4	2	5	1
April ... ..	—	—	1	—	—	25	7	1	—	—	—	—	1	—	2	4
May ... ..	1	—	6	—	—	8	3	2	—	—	—	—	—	2	4	3
June ... ..	2	—	1	—	—	11	3	—	—	—	—	—	—	—	6	—
July ... ..	1	—	2	—	—	9	1	—	—	—	—	—	—	1	4	1
August ... ..	—	1	2	1	1	12	2	—	—	—	—	—	—	1	2	2
September ... ..	—	—	2	—	—	9	4	—	—	—	—	—	—	—	—	1
October ... ..	1	—	2	—	—	14	1	—	2	—	—	—	—	1	2	—
November ... ..	—	—	1	—	—	16	6	—	—	—	—	—	—	1	2	1
December ... ..	—	—	4	—	—	32	4	—	—	—	—	—	2	2	2	—
TOTAL ... ..	6	1	33	1	1	184	52	3	4	—	4	1	9	11	38	15

PERFORMED IN 1940.

STAPHYLOMA	TRICHIASIS	TARSECTOMY	TRICHLORACETIC	TATTOO	PARACENTESIS	FOREIGN BODY IN ORBIT	XEROPHTHALMIC	RETROBULBAR ABSCESS	TUMOUR		DACRYOCYSTITIS	LACHRYMAL CYST.	PLASTIC OPERATIONS	MINOR OPERATIONS	TOTAL
									Innocent	Malignant					
—	10	—	—	—	1	—	—	—	—	—	1	—	—	—	37
—	4	—	—	—	—	—	—	—	1	—	1	—	6	—	48
—	12	—	—	1	—	—	—	—	2	—	—	—	5	—	48
—	10	—	—	3	—	—	—	—	—	—	—	—	2	—	60
—	13	—	—	—	—	—	—	—	—	—	—	—	2	—	42
—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	12
—	4	—	—	—	—	—	—	—	—	—	—	—	3	—	29
—	11	—	—	—	—	—	—	—	—	—	—	—	1	—	36
—	6	—	3	—	—	—	—	—	—	—	—	—	1	—	26
—	6	—	—	1	2	—	—	1	—	—	—	—	—	—	14
—	3	—	—	—	—	—	—	—	—	—	—	—	2	—	15
—	14	—	—	—	—	—	—	—	—	—	—	—	2	—	41
—	95	—	3	5	3	—	—	1	3	—	2	—	24	—	408

EYE DEPARTMENT 1940.

IRIS AND CILIARY BODIES				OPTIC NERVE		LENS AND VITREOUS			EYE-BALL											REMARKS.
Iridoc. & Iritis	Prolapse to Iris			Papilloedema	Atrophy	Cataract Cong.	Cataract Senile	Traumatic	Injury Panopthatis	Acute Glaucoma	Chronic Glaucoma	Rupture								
2	—	—	—	—	1	—	11	—	—	4	—	—	2	—	1	1	1	—	51	
2	—	—	—	—	1	1	6	—	1	5	—	—	—	—	1	—	1	—	47	
3	—	—	—	1	—	—	16	—	—	5	—	—	5	—	2	—	—	—	90	
1	—	—	1	—	—	1	15	2	2	4	—	—	4	—	—	—	—	—	71	
—	2	—	—	—	1	—	19	—	—	3	—	—	—	—	—	1	—	—	55	
2	1	—	—	—	—	—	6	—	—	3	1	—	—	—	—	—	—	—	36	
—	—	—	—	—	—	—	6	—	2	5	—	—	1	—	1	—	—	—	34	
—	—	—	—	—	—	—	9	—	1	3	—	—	—	—	1	—	—	—	38	
1	1	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	20	
2	—	—	—	—	—	—	2	—	1	1	1	—	—	—	—	—	2	—	32	
1	—	1	—	—	—	—	4	—	2	4	2	—	—	—	1	—	—	—	42	
3	—	—	—	—	1	—	5	1	—	3	2	1	2	1	—	1	—	—	66	
17	4	1	1	1	4	2	101	3	9	40	6	1	14	1	6	3	5	—	582	



# OUTPATIENTS TREATED IN THE

MONTHS	EYE LID					CONJUNCTIVA					Lachrymal apparatus—Dacryocystitis	CORNEA				IRITIS AND CILIARY BODY		CHOROID	RETINA		OPTIC NERVE			
	Blepharitis	Chalazion	Trichiasis	Ptosis	Injury	Conjunctivitis	Trachoma	Phlyctenular	Pterygium	Spring catarrh		Corneal growth	Ulceration	Keratitis	Leucoma	Foreign Bodies	Iridocyclitis and Iritis		Prolapse	Choroiditis	Retinitis	Detachment	Papilloedema	Neuritis
January	10	30	10	—	—	322	72	—	7	—	2	—	13	3	15	34	5	—	—	—	—	—	—	1
February	10	25	15	—	—	305	83	—	9	—	—	1	11	8	10	30	9	1	—	—	—	—	1	1
March	6	24	17	—	—	338	90	2	11	2	2	—	13	5	16	26	6	—	—	—	1	1	1	—
April	7	27	9	—	—	357	88	—	10	—	—	—	15	5	11	40	4	—	—	1	1	—	—	—
May	10	28	11	—	—	353	74	—	13	—	—	—	12	6	10	33	4	2	—	1	—	—	1	1
June	10	25	10	—	—	225	66	—	8	—	—	—	5	2	14	22	6	1	1	1	—	—	—	—
July	6	21	9	—	—	214	61	—	9	—	—	—	10	4	12	25	2	—	—	—	—	—	—	—
August	5	17	10	1	1	247	68	—	9	—	—	—	9	5	12	41	6	—	—	—	—	—	—	—
September	6	23	9	—	—	212	86	—	5	—	—	—	12	3	5	35	7	1	—	—	—	—	—	—
October	4	17	11	—	—	223	58	—	9	2	—	—	8	5	7	24	5	—	—	—	—	—	—	—
November	5	23	6	—	—	433	112	—	13	—	—	—	10	2	5	37	5	—	1	—	—	—	—	—
December	9	35	16	—	—	836	142	—	23	—	—	—	21	9	14	39	7	—	—	—	—	—	—	1
	88	295	133	1	1	4,065	1,000	2	126	4	4	1	139	57	131	386	66	5	2	3	2	1	3	4

EYE DEPARTMENT DURING 1940.

LENS AND VITREOUS				EYE-BALL					DEFECTIVE VISION					VARIOUS		VISION TEST FOR MEDICAL EXAM.	TOTAL NEW CASES.	TOTAL ATTENDANCES.
Cataract Congenital	Cataract Senile	Traumatic	Opacity	Injury Panophthalmitis	Chronic glaucoma	Acute glaucoma	Rupture	Hypermetropia	Myopia	Astigmatism	Amblyopia	Strabismus	Staphyloma	Hyphaemia	Phthisis Bulbi			
—	35	3	—	1	14	—	—	63	4	—	—	—	5	1	1	190	840	3,200
1	28	3	1	—	12	—	—	62	6	—	—	—	7	—	1	144	785	4,020
—	41	4	—	—	14	—	—	71	5	1	—	—	5	—	—	170	872	4,572
1	55	6	—	2	11	—	—	86	7	1	—	1	3	—	—	121	869	3,828
—	50	—	—	3	14	—	—	49	5	1	—	—	2	2	—	161	846	3,232
—	31	5	—	1	15	1	—	35	3	—	—	—	3	—	—	161	650	2,488
—	31	—	—	2	11	—	—	32	4	1	—	1	2	—	—	183	641	2,562
—	37	—	—	1	13	—	—	30	3	1	—	—	4	—	—	442	962	2,634
—	16	—	—	—	8	—	—	34	3	—	—	—	1	—	—	396	862	2,879
—	21	—	—	1	11	1	—	48	2	1	—	—	1	—	2	370	831	2,796
—	27	—	—	2	9	2	—	49	1	1	—	—	1	1	—	108	853	3,646
—	41	2	—	—	15	2	1	63	4	3	1	—	5	—	1	40	1,330	6,720
2	413	23	1	13	147	6	1	622	47	10	1	2	39	4	5	2,486	10,341	42,577
																		10,341
GRAND TOTAL ...																		52,918



# **REPORT ON THE STACK MEDICAL RESEARCH LABORATORIES FOR THE YEAR 1940.**

BY DR. E. S. HORGAN.

## **RESEARCH.**

The outbreak of war with Italy in June seriously interrupted the normal programme of research but fortunately it was possible for Dr. Kirk in the earlier months of the year to complete his investigations on the treatment of Kala Azar with 4:4'—diamidino stilbene (M and B 744) and related preparations.

The most important event of the year was an extensive epidemic of Yellow Fever in the Nuba Mountains, commencing towards the end of May, reaching its peak about October and rapidly dying down by the middle of November. Dr. Kirk and Mr. Lewis have been working in the area for several months, and in addition I would like to acknowledge the whole hearted cooperation and generous assistance of Dr. A. F. Mahaffy and his staff from the Rockefeller Yellow Fever Institute in Entebbe. Thanks to their assistance it has been possible to carry out an extensive programme of research in the infected area. A summary of these investigations will be found under the appropriate headings.

## **ROUTINE AND EDUCATIONAL ACTIVITIES.**

A summary of the routine work is shown at the end of the report, and it will be seen that the total number of examinations was 25,686. The 1939 figure was 24,540.

It is interesting to note that the outbreak of war was followed by a sharp drop in the number of specimens received from civil hospitals but in a short time the average monthly figure was again attained, while the latter six months have seen a considerable increase in the numbers of army specimens. The latter include tests for blood grouping in all British Troops in the Sudan, and numerous other examinations but for obvious reasons the numbers or results cannot be given.

There has been no change in the number of hospital laboratories nor of Sudanese Laboratory Assistants for the year. The assistant in Kassala Hospital was evacuated just before the Italian occupation and having promptly enlisted in the Sudan Defence Force is now attached to an advanced unit.

## **ROUTINE.**

### **PATHOLOGICAL SPECIMENS.**

The total was 490 which is a decided drop from 1939 (592).

### **POST MORTEM EXAMINATIONS.**

22 were carried out in Khartoum Civil Hospital including 9 medico-legal requested by the police authorities.

### **NEOPLASMS.**

157 received of which 96 were malignant.

SITE.	Carcinoma	Sarcoma.	Endothelioma	Melanoma.	Total
Breast ....	15	—	—	—	15
Female external genitals	3	—	—	—	3
Uterus ....	2	3	—	—	5
Testicle ....	3	—	—	—	3
Bladder ....	1	—	—	—	1
Anus ....	2	—	—	—	2
Abdomen (site unknown)	4	2	1	—	7
Thyroid Gland	2	—	—	—	2
Parotid Gland	1	—	—	—	1
Lymphatic Glands	—	5	—	—	5
Eye and Orbit	4	2	—	—	6
Face ....	2	—	—	—	2
Lip and Mouth	1	1 (Maxilla)	—	—	2
Neck ....	—	1	1	—	2
Arm and Hand	1	5	1	—	7
Scalp ....	—	—	2	—	2
Buttock	1	1	—	—	2
Thigh	1	4	1	—	6
Leg	3	4	—	1	8
Foot	2	2	1	6	11
Unclassified	3	1	—	—	4
TOTAL	51	31	7	7	96

## RABIES.

124 brains were received of which 5 were decomposed and useless.

33 were positive for Negri bodies, the distribution being 28 dogs, 1 cheetah, 2 donkeys, 1 camel and 1 human.

Rabies Vaccine. 57,825 c.cs. were issued.

## KALA AZAR.

Very favourable therapeutic results have been obtained by the use of 4 : 4'—diamidino stilbene (M and B 744) and 4 : 4'—diamidino diphenoxy pentane (M and B 800). This is a most important chemotherapeutic advance, as the results with the standard antimonial preparations, so successful in India and other countries, have been hopelessly bad in the Sudan. The results are being published in a series of papers by Dr. Kirk and co-workers. The following have already appeared or are in press :

Notes on Some Cases of Sudan Kala Azar treated with 4 : 4'—diamidino stilbene by Kirk R. and Mohammed Hamad Sati—1940. *Annals of Trop. Med. and Parasit* Vol. 34 p. 83.

The Use of Certain Aromatic Diamidines in the treatment of Kala Azar—ibid—*Annals of Trop. Med. and Parasit*. (In press).

An Unusual Case of Leishmaniasis treated with 4 : 4'—diamidino-diphenoxy pentane by Kirk R. and Macdonald D. *Annals of Trop. Med. and Parasit* Vol. 34. p. 132.

In addition the results of the Sand Fly Survey in the Sudan referred to in the 1939 Report, have been published. The sand flies (*Phlebotomus*) of the Sudan by Kirk R. and Lewis D. J. *Trans. Roy. Soc. Trop. Med. and Hygiene*—Vol. 33 p. 623.



## TYPHOID FEVER.

### RESEARCH.

The investigations on the value Vi agglutination in the detection of carriers was completed and published (Horgan E. S. and Drysdale A. 1940—Lancet Vol. 1 p. 1084).

The results confirmed the preliminary findings mentioned in the 1939 Report; that this method far from being an important aid to diagnosis as maintained by several workers, gave at the best only very equivocal results while in several cases the findings were definitely misleading. In consequence we considered that no useful purpose would be served in adopting it as a routine method.

### T.A.B. ENDOTOXOID.

Owing to the severe reactions in many subjects from the standard T.A.B. Vaccine, a trial was made of the endotoxoids as advocated by Grasset in South Africa and prepared exactly according to his technique. While only comparatively small numbers, approximately 200, have yet been inoculated, the results on the whole are concordant with Dr. Grasset's, but a few reactions have been noted.

In order to gain some information as to the antigenic efficiency of the toxoids, the bloods of 40 volunteers were examined before and after inoculation. Most of these volunteers had never been inoculated, while the remainder had had no T.A.B. within the past two years. With the exception of two who failed to develop any agglutinins all exhibited a definite increase in H.O. and Vi. antibodies comparable to the results obtained by our standard T.A.B. vaccine.

In view of the statement by Felix, that Vi. antibodies are not stimulated by the administration of formalin treated Vi. antigen, it is of interest to note that of the 38 positives 1 gave a titre of 1 in 250, 8 of 1 in 125, 23 of 1 in 50 and 6 of 1 in 25. The bloods were taken 10 days after the last dose of toxoid. With one exception—known to have had typhoid fever many years ago and whose Vi. pre-inoculation titre was 1 in 25—none of the others showed Vi. pre-inoculation titres of more than 1 in 5 (trace).

T.A.B. Vaccine. 34,600 c.cms. were issued during the year.

### BACILLARY DYSENTERY.

From the appended summary of faeces examination it will be noted that 11 of the new types of *B. dysenteriae* Boyd were isolated.

There is little doubt that 1939 has seen a definite increase of these specific types; possibly accounted for in part, by the presence of Indian troops, as according to Boyd, such types are not uncommon in India.

Of *B. dysenteriae* Flexner—51 fell into the V—Z types, while 3 belonged to the 88—Newcastle—Manchester complex.

While the writer shares the general doubts as to the pathogenicity of *B. alkalescens*, the five strains isolated may at least be of some significance, as all were obtained from blood and mucus stools from which no pathogenic organisms were isolated. The history of two is of some interest, as the patients were brother and sister—aged 3 and 5 respectively—who developed symptoms of clinical dysentery within a day of each other.

From the faeces of both, obtained within a few hours after onset of symptoms, *B. alkalescens* was present in almost pure culture.



## VACCINIA.

During the year 39 calves and 23 sheep were used ; the total yield of pulp was 2,710 gms., the average being 44 gms. per calf and 43 gms. per sheep. It will be noted that the yield from sheep, almost equals that from calves and this excellent result is due to a modification of the technique of inoculation by cross hatching the whole area, and then rubbing in seed lymph. For the details of the method the writer is indebted to Dr. D. McClean of the Lister Institute, Elstree.

Judged by potency tests, sheep lymph is quite as good as calf lymph and taking into consideration the cheapness, relative cleanliness, ease in handling and freedom from epizootics of sheep, it has been decided to use them henceforth in place of calves as routine vaccinifers.

576,440 doses of vaccine lymph were issued.

**Research.** Some trials were made of vaccinating children with the purified elementary bodies of Vaccinia virus prepared from sheep pulp. The elementary bodies were suspended in inactivated serum, or in 50% glycerin and water buffered at ph. 7.2. Rabbit tests showed a high potency  $10^{-6}$  to  $10^{-7}$ , but notwithstanding the high titre, vaccination in children was attended by no undesirable reactions. On the contrary the usual peripheral areola of inflammation was absent in the majority of cases and the vesicles were perfect in appearance. In 43 children, each vaccinated with two linear insertions (each 1 c.m.), all insertions took. In a further trial with the suspension diluted 1. in 10, 73 out of 74 children took in both insertions, the remaining child taking in one insertion only.

These preliminary observations indicate the value of such elementary bodies suspensions for human vaccinations, but so far we have been unable to confirm the claim of certain workers, that sterile suspensions, when stored several weeks at 37°C, undergo comparatively little loss of potency.

Further work on this problem is being continued as the value of such a vaccine would be very great in a tropical country with such high air temperatures as the Sudan.

## YELLOW FEVER.

A considerable amount of work has been carried out in connection with the Yellow Fever epidemic which occurred in the Nuba Mountains during the latter part of the year. Owing to the serious issues involved, the most immediate problem was to establish the diagnosis of the epidemic on a scientific basis. At the onset, malaria was excluded by the microscopical examination of large numbers of blood slides from patients in all stages of the disease. Relapsing fever was excluded by similar means and also by the inoculation of white mice. Leptospirosis was excluded by dark ground examinations of blood and urine and by guinea pig inoculations. When positive laboratory findings confirming the presumptive clinical diagnosis of yellow fever were obtained, it was unnecessary to continue the process of exclusion any further. The positive findings may be grouped under four headings.

(a) Pathological, *i.e.*, the recognition of the typical histopathological changes of yellow fever in livers obtained by viscerotomy from persons dying of the disease.

(b) Immunological, *i.e.* the demonstration by mouse protection tests, that in patients who recovered, immune bodies to yellow fever appeared in the blood during the course of the disease.

(c) Experimental, *i.e.* the isolation of typical yellow fever virus from the blood of patients during the acute stages of the disease. It may be mentioned that a strain of high virulence for animals was isolated from one of the laboratory staff who was unlucky enough to go down with the disease, but who fortunately recovered.



(d) Epidemiological, *i.e.* the demonstration by mouse protection tests, that the passage of the epidemic was followed by a rise in the proportion of immunes to yellow fever, in a random sample of sera from the population concerned. Fortunately the area had been fairly extensively surveyed in the past, and the figures of the previous surveys were available for comparison.

During the course of this work a mass of interesting data about the clinical features and epidemiology of the disease was collected. It will take some time to sift the accumulated records, but attention may be directed here to the mild case in which the clinical features consisted only of transient fever and headache, sometimes of only a few hours duration. Several such cases were observed and followed up during the succeeding 10 to 14 days during which time there was no appreciable rise of temperature and no subjective symptoms. Yet during this period the blood which had been non-protective at the onset, developed the power to protect mice against Yellow Fever virus.

The classical vector *Aedes aegypti* is widely distributed throughout the Nuba Mountains, the density being somewhat variable from place to place, and at different seasons of the year. In addition a number of species other than *Aedes aegypti* which are known to be efficient carriers in the laboratory, was found in different parts of the affected area, but it is uncertain, what part, if any, they may have played in the transmission of the epidemic in nature. This aspect of the problem is more fully discussed in the Medical Entomologist's report. Tagoi, an isolated focus in the Rashad area, which suffered over 60 deaths, provided interesting data, in that *Aedes aegypti* was the only mosquito found there, and it was abundant.

#### SUMMARY OF ROUTINE EXAMINATIONS.

Kahn Tests	....	....	....	....	....	....	....	....	....	10,497
Widal Reactions	....	....	....	....	....	....	....	....	....	1,650
Blood Cultures	....	....	....	....	....	....	....	....	....	757
Blood Films	....	....	....	....	....	....	....	....	....	658
Blood Counts (Total)	....	....	....	....	....	....	....	....	....	41
Cerebrospinal Fluids	....	....	....	....	....	....	....	....	....	59
Biochemical Tests	....	....	....	....	....	....	....	....	....	155
Autogenous Vaccines	....	....	....	....	....	....	....	....	....	13
Pathological Histology (including brains for Rabies)	....	....	....	....	....	....	....	....	....	490
Faeces	....	....	....	....	....	....	....	....	....	4,722
Urine	....	....	....	....	....	....	....	....	....	3,871
Throat and Nose Swabs : <i>C. diphtheriae</i> Positive	....	....	....	....	....	....	....	....	....	155
"    "    "    "    "    Negative	....	....	....	....	....	....	....	....	....	2,125
Sputa : T. B. Positive	....	....	....	....	....	....	....	....	....	7
" : T. B. Negative	....	....	....	....	....	....	....	....	....	44
Spleen smears (Kala azar parasites)	....	....	....	....	....	....	....	....	....	10
General Bacteriological Examinations	....	....	....	....	....	....	....	....	....	244
Water Examinations	....	....	....	....	....	....	....	....	....	187

*Summary of Faeces Examinations.*

<i>B. dysenteriae</i> Flexner	V—Z types	...	...	...	...	...	...	51
"	"	„ 88—Newcastle-Manchester group	...	...	...	...	...	3
"	Boyd	Type 170	...	...	...	...	...	2
"	"	" P 288	...	...	...	...	...	3
"	"	" D 1	...	...	...	...	...	1
"	"	" P 143	...	...	...	...	...	1
"	"	" P 274	...	...	...	...	...	4
"	Sonne	...	...	...	...	...	...	4
<i>B. alkalescens</i>	...	...	...	...	...	...	...	5
Mannitol Fermenters (inagglutinable with any sera)	...	...	...	...	...	...	...	1
<i>B. Shigae</i>	...	...	...	...	...	...	...	7
<i>B. ambiguum</i> (Schmitz)	...	...	...	...	...	...	...	13
<i>B. typhosum</i>	...	...	...	...	...	...	...	149
<i>B. paratyphosum</i> A	...	...	...	...	...	...	...	1
Amoeba present	...	...	...	...	...	...	...	9
Ova present	...	...	...	...	...	...	...	53
Negative	...	...	...	...	...	...	...	4,415

4727

*Summary of Urine Examinations (Cultures).*

<i>B. typhosum</i> isolated	...	...	...	...	...	...	...	93
Negative	...	...	...	...	...	...	...	3,778

*Summary of Blood Films for Parasites.*

Malaria :—Benign Tertian	...	...	...	...	...	...	...	44
Subtertian	...	...	...	...	...	...	...	134
Quartan	...	...	...	...	...	...	...	3
Relapsing Fever	...	...	...	...	...	...	...	4
Negative	...	...	...	...	...	...	...	473

*Summary of Widal Reactions.*

<i>B. typhosum</i>	...	...	...	...	...	...	...	392
<i>B. paratyphosum</i> A	...	...	...	...	...	...	...	2
<i>B. paratyphosum</i> B	...	...	...	...	...	...	...	1
<i>Br. melitensis</i>	...	...	...	...	...	...	...	54
Negative	...	...	...	...	...	...	...	1,291

1650

*Summary of Blood Cultures.*

<i>B. typhosum</i> isolated	...	...	...	...	...	...	...	133
<i>B. paratyphosum</i> A isolated	...	...	...	...	...	...	...	9
<i>Br. melitensis</i>	...	...	...	...	...	...	...	2
<i>Strep pyogenes</i>	...	...	...	...	...	...	...	5
Other organisms	...	...	...	...	...	...	...	9
Negative	...	...	...	...	...	...	...	599

Total examinations ... 25,686

*Vaccines Issued during the Year.*

Cholera	...	...	...	...	...	...	...	7,350 c.c.
Anti-Rabic	...	...	...	...	...	...	...	57,825 c.c.
T.A.B.	...	...	...	...	...	...	...	34,600 c.c.
Staph. Aureus	...	...	...	...	...	...	...	825 c.c.
Vaccine Lymph	...	...	...	...	...	...	...	576,440 Doses.



## REPORT ON MEDICAL ENTOMOLOGY FOR 1940.

### SANDBLIES.

The general survey of sandflies was continued and several species found here for the first time, including *Phlebotomus rodhaini* Parr. and *P. simillimus* Newst. *P. clydei* has been found biting man in houses on several occasions, and is evidently second in importance to *P. papatasi* as a biter of man in the Sudan. It was found at Um Hamra, near Gedaref, and at other places where kala-azar occurs. It is common in the Nuba Mountains.

A description of the male of *P. affinis* Theod. (D. J. Lewis and R. Kirk 1940 Proc. Roy. Ent. Soc. Lond. B. 9, 127, 128) and a general account of the sandflies of the Sudan (R. Kirk and D. J. Lewis 1949, Trans. Roy. Soc. trop. Med. Hyg. 32, 623-634) were published.

### SIMULIUM.

Many breeding places of *Simulium* sp. were found in March in the Blue Nile near Wad Medani for the first time.

### MOSQUITOES IN RELATION TO MALARIA.

#### *Anopheles pharoensis*.

Recommendations regarding mosquito control at Kosti and Sennar were made in the light of our present knowledge of this species. In these areas it is probably a vector of minor importance. In the larval stage its control is very difficult and costly, but measures against the adult are simple. Houses should be sprayed, especially the thatch porches of huts. The growth of thick herbage and the stacking of straw near houses should be avoided. Domestic animals divert the mosquitoes from man.

In the Gezira *A. pharoensis* was found to breed in certain canals, in sections opposite dura plots. Pieces of straw and dry leaves which blow into the water provide suitable sites.

*Anopheles macmahoni* Evans., which was known previously in Kenya and Abyssinia, was found in the Nuba Mountains, where it appears to take the place of *A. funestus*.

The number of species of mosquitoes known in the Sudan is now 110, 10 having been found for the first time during the year.

#### Mosquito-eating fish.

Attention was paid to these in the hope of finding means of using less imported oil and Paris green. The species tested were :—

<i>Aplocheilichthis loati</i> Boul.	<i>Tilapia nilotica</i> L.
<i>Epiplatys marnoi</i> Stein.	<i>Clarias anguillaris</i> L. (young)
<i>Haplochromis</i> sp. (multicolor ?)	<i>Gambusia affinis</i> .
<i>Micralestes acutidens</i> Peters.	

The first three are found in the White Nile. The fourth and fifth in the Blue and White Niles, and the last named is an American species.

*A. loati* and *E. marnoi* fed on anopheline larvae but did not breed readily in small pools. A specimen of the latter species from the Bahr el Ghazal was found to have eaten an anopheline larvae under natural conditions.

*Haplochromis* sp. breeds readily in pools in the Gezira but eats culicines more than anophelines and rejects certain species of culicines.

*M. acutidens* is a small voracious fish but it does not readily penetrate aquatic vegetation.

Young *T. nilotica* and *T. anguillaris* are effective in controlling mosquito larvae in pools but grow too large.

*Gambusia* sp., owing to its rapid breeding, was the most effective species. It was introduced into the Sennar reservoir, where it increased, and into bodies of water at Khartoum, Wad Medani and Rahad. At the Agricultural Research Institute this fish was used in certain irrigation channels having a total of 20,000 square metres. These subsequently required no treatment with insecticide and, except in September, an economy of 61 per cent. in the consumption of Paris green in the area was effected.

In the Annual Report for 1936, p. 82, is the statement that “*Gambusia affinis* cannot be relied on as an effective means of controlling mosquito breeding in artificial water in urban areas.” Recent observations show that in this country this fish is of great value under certain conditions in rural and urban areas, although it is not always effective if weeds grow very thickly.

Two precautions are necessary regarding the use of *Gambusia*. The first concerns the possibility of its spread to the White Nile. Several authors have pointed out the possible danger that introduced *Gambusia* may attack the fry of food fish. At present it is considered unwise to use *Gambusia* in the Upper Nile or White Nile above the Gebel Aulia dam or in water which is connected with these rivers or may flow into them. The second precaution should be taken, when moving *Gambusia*, to avoid transporting any seeds or fragments of water plants with them. This applies particularly to water weeds in the Gezira some of which do not occur elsewhere in the Sudan.

## MOSQUITOES IN RELATION TO YELLOW FEVER.

### Possible Vectors in the Sudan.

The following eleven species of mosquitoes found in the Sudan must be considered as possible vectors or Yellow Fever :

<i>Aedes aegypti</i> L.	<i>Aedes lineatopennis</i> Ludlow
„ <i>luteocephalus</i> Newst.	<i>Taeniorhynchus africanus</i> Theo
„ <i>metallicus</i> Edwards.	„ <i>uniformis</i> „
„ <i>simpsoni</i> Theo.	<i>Eretmopodites chrysogaster</i> Graham
„ <i>vittatus</i> Bigot	
„ <i>Stokesi</i> Evans	<i>Culex fatigans</i> Wied

All can transmit the virus by bite except *A. Metallicus*, *A. lineatopennis* and *T. uniformis*. The possible relation of *A. metallicus* to the virus is unknown but this species closely resembles *A. simpsoni*.

*Aedes aegypti* has been found in most of the inhabited areas of the country, but is now under control in the towns and other places. *A. luteocephalus*, *A. simpsoni* and *A. lineatopennis* are chiefly found in the south of the country and are not known to be abundant in any place. *A. metallicus* is a common tree-hole breeder occurring as far north as Khartoum. It sometimes enters houses and breeds in water vessels. *A. vittatus* is common in rocky districts south of the 13th parallel. *A. stokesi* and *E. chrysogaster* are probably too uncommon to be of any importance.



*T. africanus* and *T. uniformis* are found as far north as Kosti on the White Nile and Sennar on the Blue Nile. They breed in vast numbers in the Sudd region of the Upper Nile and bite fiercely but seldom rest in houses by day. *C. fatigans* is found at Port Sudan.

### The Nuba Mountains.

In the Nuba Mountains, where yellow fever broke out during the rainy season, 38 species of mosquitoes have been found, including all those in the above list except *A. luteocephalus*, *A. stokesi* and *C. fatigans*.

No species has been proved to be the vector in this area, but, if abundance is an indication, it seems likely that *A. aegypti* and *A. vittatus* may be the principal vectors. They are both very common. Mr. W. Rutledge, who knows the area well, states that, when working near the Koalib Hills during the rains of 1927, he was obliged to choose camp sites away from the hills, owing to the attacks of *A. vittatus*. Its eggs can be obtained during the dry season in rock holes. Many holes are made near villages by people grinding corn. *A. metallicus* is not uncommon, but most of the trees are small and do not provide suitable breeding sites.

In November and December, after the rains has ceased and the epidemic was nearly finished, many villages were searched for *Aedes aegypti*. It was not found to be abundant in any village in the epidemic area, the larval house index varying from nil to 5 per cent. except in three places. In these, Kalkadda, Kororak and Tumbira, the indices were 28, 25 and 30 per cent. respectively, the people using large water jars in which the water was stored for some time. In one area outside that of the epidemic indices of 100 per cent. were found in several villages. There was an acute water shortage with consequent storing of water in houses.

### Insects from Aeroplanes.

No. *A. aegypti* were found in aeroplanes in the Sudan.

### Education.

Instruction about the importance and habits of the yellow fever mosquito is one of the best methods of effecting its control. Several hundred visitors who came to the laboratory at Wad Medani were shown living specimens of mosquitoes in all stages.

### Tabanidae.

A species of *Haematopota* received from Zalingei, in Darfur, was reported to be rendering some roads impassable by day owing to its bites.

### Tsetse Flies.

*Glossina pallidipes* was again found on the Boma Plateau.

### House Flies.

A survey of fly larvae in pit latrines in Khartoum North and Omdurman was carried out with the help of the Public Health staff. About fifteen species were obtained. Omdurman pits contained fewer fly larvae of harmless species but more of *Musca* sp. than those of Khartoum North. The latter has a higher water table and house fly larvae are usually drowned.

### Myiasis.

Human myiasis, probably caused by the tumba fly, was reported from a wood on the Boma Plateau.

### Fleas.

All fleas received from Khartoum were *Xenopsylla cheopis*.

# REPORT ON THE WELLCOME CHEMICAL LABORATORIES FOR THE YEAR 1940.

In September the work of the Laboratories was seriously interrupted by their transfer from the quarters which they had occupied since 1902 to temporary quarters in Shambat. The following is a brief outline of the work carried out during the year.

The number of samples received from the various Government Departments and private firms was 2115 as compared to 2140 in 1939. In nature they were very similar to those received in recent years, and were classified as follows, the figures for 1939 being also given for comparison:—

	1940	1939
Waters ... ..	264	443
Foodstuffs ... ..	168	581
Medicolegal and Miscellaneous Drugs ... ..	89	87
Mineralogical ... ..	82	160
Miscellaneous ... ..	283	281
Cotton Plant Powders ... ..	1,229	588
	<u>2115</u>	

A number of samples directly associated with military activities were received for examination while several investigations, prompted by military or economic necessity, were undertaken.

## WATERS.

One hundred and forty eight of the samples received were classed as potable waters and included samples from the Khartoum, Port Sudan, Tokar and El Obeid supplies, and a number from new wells sunk in various districts near the eastern frontier and near Atbara.

## FOODSTUFFS.

Control of the Khartoum and District Milk supplies in collaboration with the Medical Officer of Health has been continued. Other samples include sugars, butters, teas, alcoholic beverages, various native foods, etc.

## MEDICOLEGAL AND MISCELLANEOUS DRUGS.

Twenty four pathological specimens, associated with seven separate cases of suspected poisoning were examined. The positive findings were copper, strychnine and hyoscyamine (two cases).

Thirty nine specimens, classified as toxicological, were received in connection with the above or other cases. Amongst these were identified lead chromate, copper sulphate, datura seed, strychnine hydrochloride, arsenic trioxide, hashish, opium and glacial acetic acid.

Amongst miscellaneous drugs are included samples of bleaching powder and bleach ointment for available chlorine content, a number of medicinal preparations and drugs for genuineness or conformity to B.P. Standards, and a few samples from the Customs Department for the presence of prohibited drugs.



## **MINERALOGICAL.**

This heading includes coals examined for the Railways ; lubricating oils and petrols ; various metals ; cements ; limes and limestones ; etc.

## **MISCELLANEOUS.**

One hundred and ten methylated spirits and 134 oil seeds of various sorts form the major part of this category. Other samples include ingredients of unexploded hostile bombs, soaps, coins etc.

## **INVESTIGATIONS.**

The principal investigations undertaken were concerned with the possibilities of the large scale production of medicinal sulphates from sea water and a search for locally available materials suitable for camouflaging tents. Other investigations of a minor character were concerned with the chlorination of water and the storage of *cracked* petrol.

## PROGRESS OF WORK.

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### CURATIVE MEDICINE.

The following figures show the number of inpatients, outpatients attendances and operations performed during the last ten years :—

YEAR.							Inpatients.	Outpatient Attendances.	Operations Performed.
1931	....	....	....	....	....	....	59,736	4,044,439	6,798
1932	....	....	....	....	....	....	59,642	4,264,412	7,287
1933	....	....	....	....	....	....	70,315	5,092,999	8,609
1934	....	....	....	....	....	....	85,990	6,039,197	10,082
1935	....	....	....	....	....	....	89,093	6,112,303	11,124
1936	....	....	....	....	....	....	96,081	6,500,441	11,229
1937	....	....	....	....	....	....	101,088	6,675,989	12,063
1938	....	....	....	....	....	....	104,366	6,989,990	11,439
1939	....	....	....	....	....	....	105,103	7,119,973	11,253
1940	....	....	....	....	....	....	104,422	6,649,335	11,139

The work of hospitals and dispensaries in many parts of the country was disorganised temporarily owing to the eastern Sudan becoming a theatre of war. Enemy occupation meant cessation of all medical work in the area concerned, and in other areas the bombing of hospitals or even the towns in which hospitals are situated reduced the work carried out. Medical work as a whole had to be maintained on a care and maintenance basis owing to the number of the British and Sudanese staff of all cadres who joined the army. As a result supervision of the district dispensaries was often inadequate and it says much for the efforts of the remaining staff who were often carrying on in the face of great difficulties that the medical work was not more seriously affected. The completion of the programme of improving hospital facilities was postponed until after the war but fortunately comparatively little remained to be done except the building of a new hospital in Khartoum of which the outpatients department and isolation wards have been completed. There are 39 hospitals, 375 dispensaries, and 6075 equipped beds administered by the Sudan Medical Service

### PREVENTIVE MEDICINE.

It has been possible to maintain steady progress in this branch which is so important in war as well as in peace that it must always be maintained at a high standard of efficiency at all costs. The standards of anti-malarial work and general sanitation continue to improve and the public health organisation proved of immense value in the present emergency. The training of subordinate sanitary staff continued without interruption. The Graphic Museum continued to serve a most useful purpose for public health propaganda. Improvement and maintenance of the standard of nutrition under war conditions received special attention. The school medical and dental services were well maintained.

### RESEARCH.

Valuable investigations were carried out in the Fung Area on the etiology and treatment of Kala Azar which have had immediate results in improving methods of treatment and reducing the mortality from this disease. The Yellow Fever outbreak in the Nuba Mountains was thoroughly investigated under difficult circumstances by a team of research, public health, medical and entomological experts.



## TRAINING.

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Courses are in being for the following categories of staff :

<i>Hospitals.</i>	<i>Public Health.</i>	<i>Laboratories.</i>
Medical Officer	Public Health Officers	Laboratory attendants.
Dispensers	Sanitary overseers	
Asst. Radiographers	House to house inspectors	
Medical Assistants	Mosquito men	
Hospital orderlies	Midwives	
Female nurses		

**MEDICAL OFFICERS.** See page 2.

### **DISPENSERS.**

Two students were under training throughout the year. In May they sat for the examination in Chemistry and all passed.

### **ASST. RADIOGRAPHERS.**

Two were under training during the year, of whom one passed out and one was discharged as unsuitable.

### **MEDICAL ASSISTANTS.**

11 completed their one year of special training in Omdurman Hospital and were posted to dispensaries. A new class of ten was then entrolled. Six medical assistants were given a refresher course during the second half of the year.

### **FEMALE NURSES.**

Seven nurses completed their training at the nurses training school during the year. Four failed in the final examination and seven were discharged as unsuitable. 18 recruits were selected to commence a two year's course of training at the beginning of the year.

**PUBLIC HEALTH OFFICERS.** See pages 2 & 30.

**SANITARY OVERSEERS.** See pages 2 & 30.

**LABORATORY ATTENDENTS.** See pages 2.

### **POSTGRADUATE TRAINING.**

Four doctors completed a six months postgraduate course in Khartoum in April. The course proved most successful.

# KITCHENER SCHOOL OF MEDICINE.

## ANNUAL REPORT 1940.

### GENERAL.

From the beginning of the year certain alterations were made in the curriculum. The course of studies in the School of Science which consists of Biology, Inorganic Chemistry and Physics was changed from four terms over a period of two years to three terms over a period of eighteen months. During the first term at the School of Medicine, Organic Chemistry will be studied with Anatomy and Physiology. The time saved will be added to the period allotted to clinical studies.

The course is now one and a half years in the School of Science and four and a half years in the School of Medicine.

### NUMBER OF STUDENTS.

At the School of Science 6 students who commenced January 1939

8 students who commenced January 1940

At the Medical School 7 students in the 3rd Year

8 students in the Final Year

### PRELIMINARY EDUCATION.

The rise in the level of general education in the candidates has allowed a standard to be set which is obligatory before entering the Medical School. This standard is the School Leaving Certificate of the University of Cambridge Local Examinations Syndicate.

### PROGRESS OF CLASSES.

Examinations were held in Anatomy, Physiology, Pharmacology, Medicine, Surgery, Obstetrics and Gynaecology.

### 3rd YEAR EXAMINATION RESULTS.

In May, 1940 seven students were examined in Anatomy and Physiology. All students reached the standard required and were allowed to pass on to their clinical studies. The Examiners were Dr. J. S. Hovell in Anatomy and Dr. R. Kirk in Physiology.

The Prize in Anatomy was awarded to Mahmud Hussein Mahmud.

The Prize in Physiology was awarded to Hasan Musa Ibrahim.

In December, 1940 seven students were examined in Pharmacology and Therapeutics. All reached the required standard and will be allowed to proceed to their final year subjects. The Examiner was Dr. D. R. Macdonald.

The Prize in Pharmacology was awarded to Hasan Musa Ibrahim.



## **FINAL EXAMINATION.**

Final examinations were held in December 1940 after permission has been granted by the Colleges to proceed without a Visitor from them. The School was fortunate in obtaining the services of Col. E. G. Oastler, F.R.C.P., F.R.F.P.S., Col. F. N. Foster, M.B., F.R.C.S., and Dr. R. M. Humphreys, D.M., who consented to act as External Examiners in Medicine, Surgery, Obstetrics and Gynaecology.

Eight candidates presented themselves for this examination.

The seven successful candidates in order of merit were :—

Dawood Mustafa — Jackson Prize in Medicine.

Waterfield Prize in Surgery.

Suliman Modawi — Jackson Prize in Obstetrics and Gynaecology.

Mohamed Ali Ahmed

Mohamed El Kheir Babikr El Shafie

Abdel Rahim Mahmoud

Abdulla Disouki Abdulla

Mowafi Abdel Fattah

They were granted the School Diploma by the General Board.

## **POSTGRADUATE COURSE.**

In March, 1940 the first postgraduate studies came to an end. The course was very successful and the graduates expressed their opinion that they had greatly benefitted from it. Unfortunately the six months course which was to have started in October, 1940 had to be cancelled as both graduates and lecturers were otherwise needed.

## **TEACHING STAFF.**

No changes took place in the teaching staff.

## **LIBRARY.**

Forty new books were added to the library which now contains 1,340 volumes. During the year 310 volumes were borrowed by practitioners and students.

## **STUDENTS' HOSTEL.**

It was proposed during the year to make an attempt to improve the hostel buildings and add to the grounds. At present, up to ten students sleep in a dormitory and there is only one common room in the building. The compound is extremely small. The conditions under which the students live have been the subject of adverse comments by Visiting Examiners. The capital funds of the School are finished and the Building Committee of the Sudan Government were not able to grant the required sum so the hostel and grounds remain unsatisfactory.

A new wireless set was presented to the hostel by Col. E. D. Pridie, C.M.G., D.S.O., O.B.E.

## **HEALTH.**

The health of the students was good. No case of serious sickness occurred. Regular medical examinations have been instituted and this has drawn early attention to minor ailments.

## **GAMES.**

Football, netball and tennis are played in the School grounds. Tennis is the most popular.

## MISSIONS.

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The following table shows the work carried out by Medical Missions :—

				Inpatients.	Outpatient Attendances	Operations.
<b>THE CHURCH MISSIONARY SOCIETY.</b>						
Omdurman. (Khartoum Province)	....	....		1,364	82,324	593
Lui (Equatoria Province)	....	....	....	572	165,839	158
Sallara (Nuba Mountains)	....	....	....	395	71,113	22
Katcha (Nuba Mountains)	....	....	....	107	12,620	67
Zeraf Island (Upper Nile)	....	....	....	60	11,584	359
<b>THE SUDAN UNITED MISSION.</b>						
Eastern Jebels (Kordofan)....	....	....	....	160	6,693	—
Rom (Upper Nile Province)	....	....	....	8	3,135	—
<b>THE AMERICAN MISSION.</b>						
Nasir (Upper Nile Province)	....	....	....	—	11,592	27
Doleib Hill (Upper Nile Province)	....	....	....	—	23,234	—



# S T A F F .

## SUDAN MEDICAL SERVICE 1940.

### APPROVED BUDGETARY ESTABLISHMENT OF CLASSIFIED OFFICIALS.

Appointment.	Establishment
<b>Headquarters.</b>	
Director ... ..	1
Assistant Director (Public Health) ... ..	1
Assistant Director (Hospitals) ... ..	1
Head Staff Clerk ... ..	1
Staff Clerk ... ..	1
Clerks ... ..	21
Head Accountant ... ..	1
Accountant ... ..	1
Book-keepers ... ..	12
Head Storekeeper ... ..	1
A/Head Storekeeper ... ..	1
Storekeepers... ..	7
<b>Hospitals.</b>	
Senior Physician ... ..	1
Senior Surgeon ... ..	1
Gynaecologist ... ..	1
Ophthalmologist ... ..	1
Senior Medical Inspectors ... ..	33
Assistant Ophthalmologist ... ..	1
Medical Sub-Inspectors ... ..	5
Medical Officers ... ..	61
Medical Assistants ... ..	274
Matron ... ..	1
Matron, Nurses Training School ... ..	1
Charge Sisters ... ..	6
Nursing Sisters ... ..	9
Radiographer ... ..	1
Assistant Radiographers ... ..	4
Pharmacists ... ..	2
Dispensers ... ..	4
Bookkeepers... ..	52
Clerks ... ..	2
Head Hospital Orderlies ... ..	31
Theatre Attendants ... ..	24
<i>Brought forward</i> ... ..	564

Appointment								Establishment
<i>Carried forward</i> ... ..								564
<b>Public Health.</b>								
Medical Officer of Health	...	...	...	...	...	...	...	1
Assistant Medical Officer of Health	...	...	...	...	...	...	...	1
Chief Public Health Inspector	...	...	...	...	...	...	...	1
Senior Public Health Inspectors...	...	...	...	...	...	...	...	11
Public Health Officers	...	...	...	...	...	...	...	13
Public Health Overseers	...	...	...	...	...	...	...	80
Principal, Midwives Training School	...	...	...	...	...	...	...	1
Asst. Principal Midwives Training School	...	...	...	...	...	...	...	1
Staff Midwives	...	...	...	...	...	...	...	2
Staff Nurse	...	...	...	...	...	...	...	1
<b>Research.</b>								
<b>Stack Medical Research Laboratories.</b>								
Assistant Director (Research) and Senior Medical Research Officer	...	...	...	...	...	...	...	1
Bacteriologist	...	...	...	...	...	...	...	1
Assistant Bacteriologist	...	...	...	...	...	...	...	1
Laboratory Assistants (British)	...	...	...	...	...	...	...	4
Laboratory Assistants (Sudanese)	...	...	...	...	...	...	...	35
Junior Technical Assistants	...	...	...	...	...	...	...	2
Clerks	...	...	...	...	...	...	...	3
<b>Medical Entomology.</b>								
Medical Entomologist	...	...	...	...	...	...	...	1
Technical Assistants	...	...	...	...	...	...	...	2
<b>Wellcome Chemical Laboratories.</b>								
Government Analyst	...	...	...	...	...	...	...	1
Chemists	...	...	...	...	...	...	...	2
Technical Assistants	...	...	...	...	...	...	...	5
Junior Technical Assistants	...	...	...	...	...	...	...	2
Clerk	...	...	...	...	...	...	...	1
<b>Kitchener School of Medicine.</b>								
Registrar	...	...	...	...	...	...	...	1
Library Clerk	...	...	...	...	...	...	...	1
<b>Graphic Museum.</b>								
Assistant Curator	...	...	...	...	...	...	...	1
Museum Attendants	...	...	...	...	...	...	...	2
TOTAL ... ..								742



## FINANCIAL.

The following figures show the actual Revenue and Expenditure of the Sudan Medical Service for the last three years :—

	1938	1939	1940
	£E.	£E.	£E.
1. Revenue ....	45,219	41,954	42,210
2. Expenditure :			
Chapter 1. Personnel and Personal Allowances ....	168,582	175,562	174,335
Chapter 2. Services ....	111,569	106,382	90,910
Chapter 3. Extraordinary Expenditure ....	3,479	3,787	1,839
TOTAL .... £E.	283,630	285,731	267,084



TABLE I.  
ADMISSIONS AND DEATHS.  
BY DISEASES.

	DARFUR		EQUATORIA		GEZIRA		KASSALA		KHARTOUM		KORDOFAN		NORTHERN		UPPER NILE		TOTAL	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1. T. B. Pulmonary ...	13	4	101	16	144	27	107	15	130	39	64	20	105	11	21	5	685	137
2. T. B. Non-Pulmonary ...	27	7	44	3	117	8	44	1	25	—	67	6	53	3	19	2	396	30
3. Syphilis ...	5,151	7	4,706	6	804	11	381	1	389	2	4,954	9	385	—	910	—	17,680	36
4. Gonorrhoea ...	240	1	934	3	470	1	356	—	431	—	436	3	314	1	310	—	3,491	9
5. Soft Sore ...	76	—	23	—	56	—	39	—	36	—	63	—	21	—	16	—	330	—
6. Trachoma ...	128	—	848	—	84	—	27	—	48	—	82	—	148	—	3	—	1,368	—
7. All other eye diseases ...	304	—	776	—	272	—	188	—	776	—	269	—	371	—	398	—	3,358	—
8. Ear ...	50	—	143	2	54	—	10	—	33	—	90	—	16	—	17	—	413	2
9. Skin ...	182	2	832	1	209	3	97	—	239	—	517	2	160	—	89	1	2,325	9
10. Wounds and other injuries ...	2,067	19	6,512	55	2,096	46	1,394	30	978	15	3,416	50	1,189	17	581	10	18,233	242
11. Tumours Malignant ...	25	6	14	1	51	10	13	3	65	11	48	5	17	3	3	1	236	40
12. Tumours Non-Malignant ...	111	—	60	1	93	—	38	—	95	—	49	—	25	—	22	—	493	1
13. Gynaecological ...	24	1	32	—	195	1	77	2	302	3	128	3	110	—	27	2	895	12
14. Confinements ...	18	—	29	1	122	10	73	2	274	14	91	7	70	5	17	2	694	41
15. Poisoning ...	22	1	15	—	64	4	22	1	8	1	6	—	13	—	1	—	151	7
16. Ancylostomiasis ...	7	—	1,855	32	34	—	19	—	14	—	3	—	67	—	69	1	2,068	33
17. Bilharziasis ...	68	—	715	15	199	4	13	—	42	—	333	1	105	—	43	—	1,518	20
18. Blackwater Fever ...	1	1	4	2	5	2	1	—	2	—	4	1	2	1	1	—	20	7
19. Dysentery, Amoebic ...	822	6	545	16	345	27	436	5	227	3	534	21	278	—	160	13	3,347	91
20. Dysentery, Bacillary ...	2	1	22	5	33	3	24	—	39	1	56	4	5	—	—	—	181	14
21. Filariasis ...	8	—	52	3	2	—	—	—	2	—	4	—	—	—	1	—	69	3
22. Madura disease ...	20	—	1	—	108	—	18	—	64	—	45	—	27	—	1	—	284	—
23. Malaria ...	489	1	771	6	2,693	28	658	3	1,368	17	1,868	15	906	11	640	7	9,393	88
24. Leishmaniasis ...	14	6	72	5	193	53	58	16	9	3	1	1	1	—	46	20	394	104
25. Trypanosomiasis ...	—	—	109	3	—	—	—	—	—	—	—	—	—	—	—	—	109	3
26. Yaws ...	7	—	3,411	6	3	—	—	—	—	—	—	—	—	—	91	—	3,518	6
27. Heat Stroke ...	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	2	—
28. Guinea Worm ...	21	—	524	1	10	1	5	—	—	—	150	—	—	—	50	—	760	2
29. Tropical Ulcer ...	362	—	2,937	3	192	—	40	—	12	—	927	1	—	—	179	—	4,649	4
30. Anthrax ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31. Cerebrospinal Meningitis ...	2	2	583	66	14	7	4	1	55	13	17	11	5	1	—	—	680	101
32. Chickenpox ...	35	—	38	—	59	—	39	—	67	—	166	—	53	—	74	—	531	—
33. Dengue ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34. Diphtheria ...	—	—	—	—	7	2	17	1	23	3	8	3	17	2	1	—	73	11
35. Enteric Fever ...	1	1	10	1	36	1	12	2	84	11	3	—	52	3	4	1	202	20
36. Erysipelas ...	1	—	1	—	10	—	1	—	—	—	4	1	3	—	—	—	20	1
37. Gastro enteritis of children ...	2	2	18	5	5	2	11	3	23	3	35	4	2	1	10	1	106	21
38. Influenza ...	101	1	123	—	9	—	53	1	54	—	124	1	86	—	23	—	573	3
39. Leprosy ...	7	2	126	10	33	—	9	—	23	—	48	2	5	1	12	—	263	15
40. Undulant Fever ...	—	—	—	—	18	1	4	—	1	—	2	—	1	—	3	—	29	1
41. Measles ...	20	—	315	2	53	—	10	—	10	—	196	2	16	—	109	1	729	5
42. Mumps ...	117	—	4	—	43	—	49	—	8	—	117	—	12	—	3	—	353	—
43. Pellagra ...	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	2	—
44. Puerperal Fever ...	4	—	2	—	10	—	2	—	1	—	6	—	4	—	—	—	29	2
45. Phlebotomus Fever ...	13	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	13	—
46. Pneumonia ...	101	20	348	44	374	44	204	36	229	54	171	42	162	25	44	5	1,633	270
47. Rabies ...	14	1	—	—	4	4	2	—	1	1	1	1	2	1	1	—	25	8
48. Relapsing Fever ...	46	6	—	—	256	20	117	6	102	3	72	8	21	—	—	—	614	43
49. Acute Rheumatism ...	103	—	12	1	18	1	50	—	29	1	37	—	49	1	5	—	303	4
50. Smallpox ...	39	5	1	—	7	—	—	—	2	—	2	1	—	—	—	—	51	6
51. Tetanus ...	2	1	1	—	9	2	1	—	4	—	3	2	—	—	3	1	23	6
52. Whooping Cough ...	3	—	1	—	16	1	1	—	14	1	29	1	3	—	—	—	67	3
53. Circulatory System ...	67	11	277	9	207	24	133	22	259	36	160	19	137	12	15	4	1,255	137
54. Respiratory System ...	119	2	915	26	598	31	373	3	439	11	782	50	334	9	188	7	3,748	139
55. Alimentary System ...	283	14	921	35	1,069	92	401	19	874	38	1,252	53	505	13	201	19	5,506	283
56. Genito-Urinary Sytem ...	82	5	281	—	373	19	157	11	283	19	345	23	191	15	41	—	1,753	92
57. Nervous System ...	31	3	65	4	100	15	50	4	102	7	101	7	64	1	18	1	521	42
58. Scurvy ...	1	—	2	—	151	6	10	—	1	—	20	—	—	—	4	1	189	7
59. Diabetes ...	3	—	4	—	35	3	11	—	86	—	12	3	27	2	1	1	179	9
60. Fever of uncertain origin ...	102	6	349	1	428	23	369	17	247	9	96	10	194	5	18	—	1,803	71
61. All other diseases ...	334	8	2,536	26	808	14	558	22	855	47	621	11	429	3	629	1	6,770	132
TOTAL ...	11,892	153	33,020	416	13,399	551	6,787	227	9,484	366	18,636	404	6,763	149	5,122	107	105,103	2,373





TABLE II.

## OUT-PATIENTS

## NEW CASES BY DISEASES

and

## TOTAL ATTENDANCES.

	Darfur	Equatoria	Gezira	Kassala	Khartoum	Kordofan	Northern	Upper Nile	Total
1. T. B. Pulmonary	44	56	234	151	209	62	252	26	1,034
2. T. B. Non-Pulmonary	168	19	121	122	56	67	44	41	638
3. Syphilis	16,089	5,335	12,782	4,871	3,740	20,895	3,683	11,484	81,879
4. Gonorrhoea	872	1,341	2,473	2,446	1,609	1,700	971	839	12,251
5. Soft Sore	654	33	422	695	277	307	4,269	206	6,863
6. Trachoma	3,985	5,081	32,592	16,937	17,917	3,426	37,919	901	118,758
7. All other eye diseases	6,087	19,161	43,673	19,468	21,822	17,137	28,870	9,318	165,536
8. Ear	1,727	5,158	11,685	7,173	5,555	5,256	8,524	1,512	64,590
9. Skin	6,864	16,119	8,521	2,846	3,159	14,318	8,812	3,495	64,134
10. Wounds and other injuries	23,265	95,774	146,556	89,579	119,531	59,999	43,712	10,905	589,321
11. Tumours Malignant	66	—	204	100	156	52	32	9	619
12. Tumours Non-Malignant	900	25	3,776	1,101	1,460	401	657	94	8,414
13. Gynaecological	25	4	348	186	1,370	295	228	28	2,484
14. Confinements	4	4	74	27	366	52	296	23	846
15. Poisoning	21	23	95	—	62	10	19	5	235
16. Ancylostomiasis	322	2,379	45	46	39	7	625	70	3,533
17. Bilharziasis	658	857	1,764	125	1,002	3,425	2,343	100	10,274
18. Blackwater Fever	4	4	1	2	2	2	1	1	17
19. Dysentery, Amoebic	—	1,361	8,016	3,918	2,856	2,559	3,872	1,276	26,292
20. Dysentery, Bacillary	2,434	—	400	278	384	153	253	—	1,509
21. Filariasis	3	48	3	1	—	4	—	1	60
22. Madura disease	10	20	720	26	98	29	18	1	922
23. Malaria	4,012	5,764	56,830	9,237	11,606	30,449	16,863	4,660	139,421
24. Leishmaniasis	9	108	1,723	22	9	3	—	47	1,921
25. Trypanosomiasis	—	56	—	—	—	—	—	—	56
26. Yaws	279	23,309	—	—	—	4	—	417	24,009
27. Heat Stroke	—	—	34	—	—	—	4	—	38
28. Guinea Worm	287	2,368	297	6	—	470	—	168	3,595
29. Tropical Ulcer	1,096	19,148	781	1,043	15	3,242	189	3,504	29,012
30. Anthrax	—	—	—	—	—	—	—	—	—
31. Cerebrospinal Meningitis	1	236	55	4	18	15	3	2	334
32. Chickenpox	67	14	168	31	83	234	157	92	846
33. Dengue	4	—	—	—	1	—	—	—	5
34. Diphtheria	4	—	6	27	18	6	8	4	73
35. Enteric Fever	1	—	—	3	36	—	27	10	77
36. Erysipelas	—	—	1	2	11	3	7	—	24
37. Gastro enteritis of children	228	326	1,064	192	2,189	893	1,071	44	5,907
38. Influenza	1,083	1,155	1,835	2,396	2,183	233	1,923	53	10,861
39. Leprosy	72	251	78	8	13	124	6	18	570
40. Undulant Fever	—	—	3	1	1	1	—	3	9
41. Measles	36	346	1,050	74	319	663	763	282	3,633
42. Mumps	261	12	736	172	765	293	502	27	2,768
43. Pellagra	—	—	—	4	—	4	—	—	8
44. Puerperal Fever	1	—	40	41	22	7	55	1	131
45. Phlebotomus Fever	—	—	16	92	1	—	46	—	155
46. Pneumonia	153	206	1,101	321	376	287	804	97	3,345
47. Rabies	17	—	26	51	7	10	5	3	119
48. Relapsing Fever	43	—	457	81	116	15	220	—	932
49. Acute Rheumatism	585	92	1,099	1,561	1,465	301	1,558	107	6,768
50. Smallpox	76	—	11	—	6	3	—	2	98
51. Tetanus	1	—	2	—	2	2	—	3	10
52. Whooping Cough	25	74	1,239	212	1,226	544	853	59	4,232
53. Circulatory System	141	92	2,086	1,902	1,623	1,023	1,636	275	8,778
54. Respiratory System	6,944	42,039	42,336	28,390	14,353	29,131	31,976	5,167	200,336
55. Alimentary System	18,127	22,278	65,621	36,296	25,805	36,993	47,444	5,110	257,674
56. Genito-Urinary System	1,689	57	7,251	1,533	2,092	2,055	2,285	83	17,045
57. Nervous System	39	14	3,478	1,702	1,464	1,157	3,212	220	11,286
58. Scurvy	1	—	403	61	7	37	26	60	595
59. Diabetes	2	1	816	45	94	27	128	—	1,113
60. Fever of uncertain origin	1,592	2,364	20,208	7,641	6,553	4,240	7,734	998	51,330
61. All other diseases	9,410	15,981	113,814	23,643	28,767	15,608	32,098	4,555	242,876
<b>Total New Cases</b>	110,529	289,178	599,170	269,856	282,918	258,234	297,003	66,406	2,173,294
<b>ATTENDANCES :</b>									
<b>MEN</b>	155,827	378,645	689,358	422,274	300,701	447,590	408,195	90,022	2,892,612
<b>WOMEN</b>	74,684	174,572	270,842	94,934	192,895	231,357	244,069	50,364	1,333,717
<b>CHILDREN</b>	90,164	193,633	434,841	160,769	237,089	380,301	536,428	57,859	2,091,084
<b>ATTENDANCES :</b>									
<b>DRESSING STATIONS</b>	—	254,594	—	74,069	197,523	—	240,374	—	766,560
<b>Total Attendances</b>	320,675	1,001,444	1,395,041	752,046	928,208	1,059,248	1,429,066	198,244	7,119,973



